This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg. U. S. Pat. Off.

The editors will exercise care in checking on the accuracy of data printed, but in all other respects articles and opinions of which expression is allowed are the opinions of their authors—the editors reserving in all cases the right to comment on the same, in the current or any subsequent issues, as they may be inclined.

The Journal of Occupational Diseases and Traumatic Surgery

The Science, the Law and the Economics of Industrial Health

Volume 7 SEPTEMBER, 1938 Number 9

Industrial Medicine

—The Plan and Scope of the Interest of the National Association of Manufacturers in This Field—

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I BELIEVE at the outset it is proper to be perfectly frank and attempt to clear up some misconceptions concerning the work the National Association of Manufacturers is attempting to do in the field of industrial health.*

In the first place, it is perhaps unfortunate that the author of this article is sometimes thought of as a Research Director. While the title may adequately cover my planned activities, it easily leads to a misunderstanding of my intentions in the average mind. It often serves to generate the impression that the first step on the N. A. M.'s part will be the inception of vast independent surveys and new statistical studies in fields now inadequately covered.

If this were true, of course, it would represent a gratuitous slight to all the splendid work that has already been done in the field of industrial medicine. Fortunately, it is not true at all.

As a matter of fact, we have set aside no appropriations to finance activities of this scope. Such surveys would naturally need to be exhaustive, and they would not yield a return in proportion to the effort and expense involved. Existing material in the field is quite adequate for our requirements.

What we are really anxious to do is to make very complete use of the material that already exists. Just as the National Association of Manufacturers itself has served as a coordinating body to learn the best industrial practices and spread knowledge of them throughout industry, our particular arm of the service will try to coordinate the best practices in industrial medicine in an effort to adapt them to the varying types of manufacturing plants, no matter how small or strictly budget-ridden.

This leads naturally to a discussion of one other point in which the N. A. M. can be of real service to industrial medicine. Individual doctors faced with the necessity of proving the value of their work in plants and factories are well aware how difficult it sometimes is to convince the manufacturer. It is not always easy to prove that in the long run something which involves an added expense will more than pay for its initial cost; it is particularly hard for an individual to prove this.

Here the manufacturers' group, with its experience in "selling" good industrial practices on a factual basis, hopes to be of service. Its word carries weight; the businessman, large or small, realizes that the association has his interests in mind, and as a result he is much more likely to heed its recommendations.

These two activities, then—coordination and "selling"—are the ones in which the N. A. M., because of its unique position and experience, can admirably serve the industrial doctors *and* the industrialists of this country.

That is the thought which really determines the duties of my newly acquired post.

NOW for a second prevailing conception concerning my work. Many people seem to think that we are going to emerge almost immediately with a long report on our findings, full of final recommendations on best practices. Of course, doctors are not numbered among those who believe this. We are going to study the whole subject for a long time before taking upon ourselves the consideration of a working model for industry.

The main problem, as I see it, is to take the excellent work that has been done and extend it to

* Written especially for INDUSTRIAL MEDICINE.

include the little fellow who has little or no knowledge of what can be done, or who believes that obtaining healthful working conditions inevitably involves great expense. It is worthwhile, then, with the assistance of the experienced duties in industry to take enough time to build a good working model, one that will meet the most exacting of these requirements.

In drafting any health plan, of course, we must take account of two chief factors: occupational hazards, and ordinary sickness. Though the former is certainly the more spectacular, the latter has certainly involved a greater loss of man-hours. Both must be studied in correct proportions.

Of the occupational sicknesses, special attention must be devoted to prevent hazards like silicosis and to lead poisoning.

There is no doubt in my mind that cases of this kind can be greatly reduced.

We still have an open mind on all the subjects I have so far mentioned. We are working slowly towards a plan of action, we are studying the best practices now in use, and we are conferring constantly with members of our advisory board.

One other point besides those already mentioned, one in which I am considerably interested, is the possibility of using what might be termed industrial psychology.

The British have been quite active in this field for a number of years, and some of their activity is well worth our attention.

On my last trip abroad I came across an interesting case which seems extremely simple and obvious when described, but which would probably be rather unusual here:

A company had just hired an excellent sales manager of the go-getting, dynamic type. There was only one cloud on the horizon so far as the company was concerned: he had never kept any previous job for more than a year, and the company naturally wanted to know why. A little investigation disclosed the fact that the man was a bully who constantly browbeat the salesmen under him.

A course of treatment was decided upon.

The chairman of the board called the salesman into his office, and, as soon as he appeared, shouted at him: "Hey, you big lummox! What do you mean, coming in here without knocking?" This treatment was repeated in varying forms for several days, and ended suddenly one morning when the former bully broke down in tears. Then his employers found themselves in a perfect position to point out the grave defects in his own attitude towards those under him.

This may seem like a far field for the industrial doctor to stray into, but I believe that in the course of the next five or 10 years the industrial doctor is going to find his activities very greatly enlarged. There are many places where his medical knowledge, and the knowledge of human nature which this certainly involves, can be of value. Cases of the type I have mentioned above belong to a large group which certainly ought to be within the province of the medical man.

There is another question that follows naturally from this one. How much mental fatigue and disturbance do machines cause? A great deal, according to popular fancy. In actuality, probably much less than is commonly believed.

Boots, the big English chemical company which employs 50,000 workers, has completed an exhaustive survey on this very subject. The survey concludes that the health of the company's workers is superior to that of workers on farms, because of the healthier surrounding conditions. This is not universally true, but it tells a true story of a modern factory using the latest health knowledge and sanitary standards.

I SAID before that the industrial doctor is gradually finding himself engaged in new activities of many types. One of the most interesting of these, and one which the National Association of Manufacturers would like to see developed to perfection, is the practice of finding employment for the bodily handicapped. Here the doctor's knowledge of a man's physical shortcomings is the vital point.

One manufacturer I know of has found out, for example, that in many instances he can give employment to the blind, and I was quite surprised to learn the number of blind people now on his payroll. Men and women with heart trouble, who formerly were often turned away from jobs, now are being shifted to work that they can do.

To the industrial doctor of the future, with his exact knowledge of fitting the man correctly to the job, these will seem like crude and obvious examples; but today they are encouraging signposts on the road to progress.

The N. A. M. Committee on Healthful Working Conditions is open-minded as to where the studies will lead. No one can correctly estimate at this time just how far some of the subjects I have mentioned above are likely to lead us. Nor is the range of possible subjects more than touched upon in the present article.

At this point, I am merely able to indicate some of the matters that interest us and interest the industrialist.

Our greatest encouragement at this point is the free access we enjoy to the best experience in the field of industrial medicine.

We are fortunate, too, in having the active support and guidance of the N. A. M. Committee on Healthful Working Conditions, of which FRANK PURNELL, President of the Youngstown Sheet & Tube Company, is Chairman. Through it and the Association, we are ensured the cooperation of leading manufacturing companies and manufacturers' organizations throughout the country.

A representative committee of company medical men has been selected to plan and advise with the membership of the Committee on Healthful Working Conditions. This is under the Chairmanship of DR. W. IRVING CLARK, Personnel Director of the Norton Company, Worcester, Massachusetts.

This committee is by no means complete as yet,

but all the doctors so far invited to join have accepted. The members to date are:

W. A. BREWTON, Plant Physician, American Enka Corporation, Enka, North Carolina.

DR. WILLARD J. DENNO, General Medical Director, Standard Oil Company of New Jersey, 30 Rockefeller Plaza, New York, N. Y.

PROFESSOR PHILIP DRINKER, Harvard University School of Public Health, Department Industrial Hygiene, 55 Shattuck Street, Boston, Massachusetts.

DR. GEORGE H. GEHRMANN, Medical Director, E. I. du Pont de Nemours and Company, Incorporated, Wilmington, Delaware.

DR. T. LYLE HAZLETT, Medical Director, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

DR. W. J. MCCONNELL, Assistant Medical Director, Metropolitan Life Insurance Company, 1 Madison Avenue, New York, New York.

DR. C. D. SELBY, Medical Consultant, General Motors Corporation, Detroit, Michigan.

DR. LOYAL A. SHOUDY, Chief of Medical Service, Bethlehem Steel Corporation, Bethlehem, Pennsylvania.

DR. CASSIUS H. WATSON, Medical Director, American Telephone and Telegraph Company, 195 Broadway, New York, New York.

THE American College of Surgeons, with its many hundreds of members engaged in work similar to that we are undertaking, has offered its fullest cooperation.

The same is true of other private and governmental organizations.

Already associated with me in this work is DR. DONALD M. SHAFER, a native of Grove City, Pennsylvania, graduate of the Cornell University Medical School, and formerly associated with the Medical Department of the Standard Oil Company of New Jersey.

Throughout our work, we are going to try to keep one principle in mind: we are going to try to "make haste slowly." Too many ambitious projects have been wrecked on the rocks of too hurried execution. The National Association of Manufacturers and the doctors it has enlisted are determined to achieve a firm groundwork upon which to base the best industrial practices of the future.

In view of the quantity and quality of the work already done in the field, and because of the fine cooperation we have already received, we look forward to the day when the average small manufacturer will be just as well equipped to provide healthful working conditions as the large corporations now are.

We look forward, too, to a greatly broadened concept of the industrial doctor's duties.

And when once these things have been accomplished, healthier and happier workers will be the inevitable by-product.

It is with this goal in mind that we start off on a course the end of which is not yet in sight.

The Physician in Industry

A. D. LAZENBY, M.D., F.A.C.S.,
Baltimore, Maryland

I APPROACH my task of addressing you upon the subject of "The Physician in Industry" with mixed emotions. I believe with all my heart that the subject bears deeper implications than most of us have assigned to it in the past. I realize the conflict in ideas that exists in medical and lay circles relating to the health problems of our society, and I am not prepared to offer you any panacea for these pressing problems. I aspire only to stimulate your thought.

We are very much concerned these days, as a profession and as a society, by the changes in our social order, which we see approaching. Truly, we are confronted with revolutionary modifications of our way of thinking and of our approach to many of our social problems, especially as they involve the question of health. We are trying to solve these enigmas by legislation, by regulating the law of supply and demand, by attempting to govern artificially the operation of the laws of Nature. But I fear we are stymied in our efforts to secure an answer until we attack the fundamental element, Man. We as citizens have a deep but an abstract interest in the social aspects of the problem, but as physicians we have a very profound and a very concrete interest in man himself, with his physical, psychological, mental, yes, spiritual problems.

We are learning a new sense of values—the predominance of human rights over property rights. For generations we have been living in the midst of selfishness—individual, civic, national and international—and today we have reached the peak of the curve. We must stretch our capacities almost to infinity if our democratic principles of national life are to be preserved. Our thought along all lines must be broad in scope and focused upon the benefit to many, instead of to ourselves or to our own particular group. As civilization becomes increasingly complex, as progress takes place, as time marches on, our profession must continue to serve and advance in step, never forgetting the bright design it contributes to the fabric of human happiness and development, and never letting that design lose its lustre or get out of perspective.

Like every other part of our social fabric, industry and labor have undergone radical changes—changes not merely in philosophy, but in manufacturing practices as well. The principle of mass production has become almost a fetish, with all the human wear and tear that must accompany the assembly line. New substances are constantly being introduced into industrial processes, with certain known and many unknown effects upon the workers exposed. Newly created laws dealing with the control of and compensation for certain diseases of industry have focused the atten-

* Presented at The Atlanta Graduate Medical Assembly, January 25, 1938; also given original publication in *Georgia Medical Journal.*

tion of industrialists, labor leaders and physicians as well upon the so-called "occupational diseases." Indeed, industry has become all too belatedly medically conscious, and it behooves our profession not merely to contemplate the scene, but also to participate actively in the health problems of industrial life.

My effort in addressing you today will be designed to assist the doctor in orienting himself with reference to industry, to point out the needs that exist for his services, and to offer a few suggestions as to how those needs may perhaps be met.

THERE are 14 million people in this country engaged in the manufacturing and mechanical industries in 1937. There are more than 900 occupational exposures to toxic materials and conditions, many of them affecting the health of the worker adversely. Forty per cent of the industrial population of this country is exposed in varying degrees to conditions existing in the working environment. Disabling illness is 76% higher among unskilled labor, 40% higher among skilled labor, than in the so-called non-industrial group. The death rate among skilled labor is 24% higher, among semi-skilled labor 50% higher, and unskilled labor 116% higher, than in the non-industrial group.[1]

I cite these facts to bring vividly before you the unassailable conclusion that regardless of the cause, there is more sickness, more death, more misery among our industrial population than among any other class. Certainly it is not difficult to conclude that perhaps the hand of our healing art rests all too lightly upon the suffering heads that need it the most.

There is a growing agitation in lay and government circles, shared by a large and growing group of our own profession, advocating the creation through government of some means of meeting the problems of sickness among our low-salaried wage earners. Inasmuch as most of this latter class of our population are engaged directly or indirectly in industrial pursuits, perhaps a very constructive approach to the question of improvement and maintenance of our national health might be had through the concentration of our thought upon the health problems of industry.

THE environment in which a man spends most of his life, whether it be his home or the factory in which he works, influences to a tremendous degree his physical and mental health. I do not wish to imply that all of the ailments of the industrial worker have their origin directly in his place of employment. But it is indisputable that much exists within the walls of industry to contribute to the physical misfortunes of the worker, and within those walls there lies a field of activity in preventive medicine that invites the interest of all of our profession.

Certainly the unfortunate health picture which we see in our industrial population is due in part to economic factors which have made impossible proper housing, correct diet, ample recreation, and the prompt seeking of medical care. It may appear to you that these problems of housing, diet and nutrition concern us more as citizens than as physicians. But on closer examination we can well declare that medicine shares responsibility for all the train of evils which directly or indirectly spring from diminished efficiency of our workers due to their remediable physical defects.

An unhealthy worker is an inefficient producer; consequently, he is an inefficient earner. It follows, then, that he has not the means to be an efficient consumer. He has not the means to afford proper medical care from private physicians. It is a vicious circle which operates to the detriment of the individual, his employer, the medical profession and society at large. To this extent many of the health problems of the working man are directly our responsibility. At the present time, if the average industrial worker is not what has been poetically described as "the forgotten man," at least he is the man who has escaped our notice.

Industry deals with men as well as with machines and materials. Unfortunately it has not fully realized that the man who runs the machine and molds the material is, after all, the most important element of the three. Though management in the past has been inclined to regard the physical well-being of its man power as of secondary importance, the time has come when the human element is attaining prime significance. Already many industries regard their plant physician as of equal importance to their plant maintenance engineer. They regard the task of conserving their man power, keeping it in good repair, keeping it constantly on the job, as of equal importance to the constant adjustment and maintenance of their machines and equipment.

For this, industry needs the doctor. The fact that industry did not long ago realize this need is perhaps a reproach upon our profession, for we have failed to educate industry properly or make obvious the tangible value of services which we alone are equipped to render.

The day has come when medicine and industry must work together. When the physician enters industry, he must not be brought in on any false or hypocritical grounds. The industrial medical department must function as a part of the practice of good business and good medicine, and not philanthropy. It must serve employer and employee in equal measure, but must never be paternalistic. In other words, the medical department in industry must be just a hard-headed business step toward improving men and women productively, just as the installation of a new machine or a new process will increase plant productivity. Fortunately, a community of interest exists, so that as the interests of the employer advance by intelligent health conservation, so in exact ratio will those of the employee advance.

The introduction of medical service into industry is not an easy task. We are not, as is com-

1. Annals of the American Academy of Political and Social Science. Problems of Organized Labor. Volume 184.

monly supposed, a nation of big industries. More than 98% of all of the industrial plants in this country employ less than 500 men. Of those industrial establishments having an annual output of more than $5,000, 96,000 have five or fewer employees. It is comparatively easy to introduce medical service into large plants. Almost without exception larger business institutions have the benefit of medical advice. All too often, even in large industries, the physician devotes himself exclusively to the practice of minor surgery. But the fact remains that he is there; with a little vision and initiative, if he cares to assert it, he should be able to convince his employer of the great need for the broadening of his scope of activities.

The industrial medical department must be under the personal direction of a competently trained physician. He must have at his disposal, when necessary, the advice of competent consultants, with suitable hospital facilities. He must have surgical and diagnostic equipment sufficient to enable him to do competent work.

The plant medical department must be housed and equipped in such a manner as to command the respect of the personnel of the institution which it serves. It must have the dignity and atmosphere of the office of the private practitioner if it is to exert its fullest good. Many industrial physicians are called upon to work in dark basement rooms, in some forgotten corner of the plant, poorly lighted, poorly equipped, at times actually unclean. Industry needs the physician as an important official of the company, reporting only to an executive officer, with reasonable authority, housed in an environment that not merely stimulates his own pride and self-respect, but which is calculated to inspire the respect and the confidence of the worker with whom he comes into contact. His professional environment, his responsibilities, his income, his opportunities for personal and professional development must at least be comparable to those of which he is worthy in private practice. Perhaps one of the reasons why the industrialist does not always regard his plant physician as one of the valuable adjuncts of his personnel is because he has not chosen his physician wisely, nor nurtured him under conditions that will enable him to exemplify his full value.

The records of the industrial medical department must be carefully and fully kept. The careful study of these records will often reveal the so-called "repeater;" the man who for one reason or another is continuously having accidents or is often sick. Perhaps the fault may be inherent in the particular processes or machines with which he is engaged. If so, a warning from the physician to the engineer may result in the removal of the hazardous conditions. Perhaps the fault may be in the man himself. Then his physician will review the physical status of the individual very carefully in an effort to discover possible physical defects.

The strongest ally of the industrial physician in this activity should be the private practitioner. There should be no infringement of the activities of the one upon the other. The plant physician should never undertake the treatment of conditions which under ordinary circumstances would go to the family physician. His task is that of prevention—the prevention of minor things from becoming major. His is the task of direction, seeing that the sick man finds his way into his private physician's capable hands. His is a task of advice. Better far to prevent a disease than to attempt to cure it.

THE small industrial plant is often more in need of medical advice than the large one. We find, generally speaking, that toxic materials are handled more safely and under better engineering and medical precautions in large plants than in small. All too often the greatest health hazards lie in the smaller plants, ill-equipped physically to cope with toxic fumes, and poorly equipped financially to provide for adequate plant hygiene. If the physician's services are needed in the big industries, they are much more needed in small ones. Here lies a problem that deserves the most constructive thought of all of us. Can it best be handled by a group of small industries collaborating in the securing of the services of a competent industrial physician? Especially in so far as the prevention of occupational disease is concerned, can it not best be accomplished by our encouraging the creation of scientific and non-political units of industrial health or of environmental hygiene in our city and state health departments? The problem challenges the best thought of our profession. It offers, incidentally, a splendid opportunity for scientific work and professional advancement among some of our younger well-trained physicians who now struggle for livings in our big cities.

The pre-employment or placement physical examination is one of the most important procedures in preventive medicine that offers itself to the practitioner in industry. It has implications, however, that extend far beyond the mere selection of physically perfect personnel. It has social aspects also, and it is here that this valuable procedure often fails to accomplish its purpose. Organized labor is actively antagonistic to placement physical examinations, and this antagonism has extended to the dangerous point of opposition, even in workers who are to be exposed to dust, lead or other similar intoxicants. Organized labor indeed may have a valid basis for objection, and except in the instance of occupational disease exposure, I fully recognize its point of view.

It is quite evident to me that the approach to the problem of bettering the health status of the worker must lay its greatest emphasis upon prevention. The placement physical examination must thus be a means to an end, not the end itself. If this examination is designed merely to exclude from employment those workers who are physically impaired, it defeats its most important social aim. If it contemplates the matching of

man and job, it possibly barely justifies itself. But if it contemplates as well the correction of remediable physical defects, it opens the way to a solution of the whole problem, with all of its social and economic as well as humane aspects.

IN FACING this problem we must think our way directly to its heart, cutting all the strands of tradition, ethics and preconception in so doing. It is perfectly useless to tell a man he has a hernia if something is not to be done about it. It is absurd to discover a sufferer from diabetes if he is to be allowed to continue on the road to death. There is no point from a broad angle in discovering an impairment of vision if the means are not available to correct the impairment. The correction of such conditions is theoretically the responsibility of the worker himself. But all too frequently the jobless man finds it impossible to pay for the medical attention he needs. It is certainly not the task of the employer, who has a right to expect those who offer him their services to be able to perform the tasks assigned them. The responsibility of the employer ends when he adjusts his personnel methods in such a way that jobs and men may be appropriately matched.

It is no more the responsibility of the medical profession to carry the physical burdens of the indigent industrial worker, than it is the function of the grocer or the tailor to feed or clothe him. Appropriate medical care to the indigent is a problem which rightly belongs to society. The medical profession has always been ready and willing to do its part, but there is no sound ground for exploiting the medical profession to the extent of demanding of it the complete assumption of a social burden which rightly belongs to the entire local community.

I offer no panacea. Means to pay the doctor for his work in caring for the indigent sick and in rehabilitating the handicapped worker, who, but for his curable ailments, would be fully able to take his own place in society, should be provided by the local community from public funds. Of course, such funds should never be applied in any manner calculated to deprive the individual of his proper share of responsibility, or of his personal initiative in the choice of his physician. Such activities should be conducted entirely under medical auspices and direction, without political or bureaucratic interference.

I hold it to be a social axiom that every citizen, except the actual invalid, is entitled to an opportunity to earn a livelihood. A program of placement physical examination that is designed to bar from employment all save the physically perfect, all those suffering from physical defects that may be remediable, but which the strains of toil may aggravate into a compensation claim, is socially unsound. I readily admit that there is no more basis for expecting the employer to adopt a policy of *caveat emptor* toward the men whose services he purchases than toward the material he buys, but there are important social values that exist in the first instance that are not present in the second.

The placement physical examination to be valuable in its broadest sense, must be thorough. It is needless for me to discuss the routine that should be followed, because all in this audience know what comprises a thorough physical examination. Suffice it to say that such an examination should include blood pressure and hemoglobin determinations, a complete urinalysis, and a serological test for syphilis. This examination must be extended even farther where industrial exposure to toxic dusts or fumes is contemplated, to discover those who, by reason of some obscure physical defect, may be peculiarly susceptible to intoxication.

The so-called medical inspections practiced in some industries, conducted in at least one large plant of my acquaintance by a first aid man, are worse than useless, and fully worthy of the condemnation which organized labor has showered upon them. They deserve equally the condemnation of our profession.

The cautious policy assumed by business management toward employing handicapped workers is fostered to a certain extent by the attitude of many of our profession. In a desire to be absolutely fair to a worker suffering from an alleged accidental aggravation of a pre-existing disease, often physicians think beyond the limits of reasonable possibility into the realms of remote chance. Let us hope that their flexibility of opinion is never tinctured by their desire for a fee. Let us always be fair. Let us resolve reasonable doubt in favor of the claimant. But let us never create unreasonable doubt nor pander to the desire of our patient to capitalize upon his illness.

Consider the terrific impact which the full completion of the health program, which I have just outlined, would have upon our syphilis problem and upon our tuberculosis problem alone, not to speak of the stupendous influence that would be exerted upon the entire health picture of our people.

ONE of the great problems confronting industry today is that of the occupational diseases. This problem is no less vital to the entire medical profession, not merely from the purely scientific angle, but from the economic as well. Not so many years ago workmen's compensation laws were passed for the protection of industrial workers against occupational accidents. Unfortunately, when these laws were drafted the medical profession, although deeply involved, was not consulted, nor did it recognize its own deep interest and insist upon participating in the creation of this new social practice.

Workmen's compensation has now come to be accepted as a definite part of our social system. The fact nevertheless remains that so far as the practice of medicine is concerned, it is a distinct step toward socialization, particularly in so far as it contemplates the payment of professional fees by an agency other than the individual who receives the services. A certain bureaucratic control necessarily exists. Certain restrictions and

limitations are placed upon the medical profession as to fees, as to relationships with the patient, and the doctor is brought into a relation with industry and with government which is quite foreign to his traditional past. However, as the years have gone by, all of the elements involved in workmen's compensation for industrial injuries have adjusted themselves fairly well, considering the wide conflict of interest that must of necessity exist.

But now there has appeared on the horizon, indeed it has already manifested itself in our very midst, the question of compensating for occupational diseases as well as for occupational injuries. Many states now have such laws in effect. If one reads the signs correctly, the workmen's compensation principle is going to be broadened greatly in months to come. Indeed, if it is just that industry should bear the cost of human wear and tear through occupational accidents, it is equally fair and just that industry should bear the cost of the diseases, which, through processes inherent to it, it also produces.

Many occupational disease laws are very broad in construction and susceptible to even broader interpretation. It is possible in many states to compensate a worker for almost any disease to which mankind is heir, provided it can be associated even in the most remote manner with his occupation. A little flexibility of medical opinion, the invocation of the laws of remote possibility as against those of reasonable probability, make such an association very easy.

THE entire medical profession should have an intense interest in the regulation of and active participation in any program which offers such grave potentialities for the socialization of medicine. Please do not misunderstand me. I recognize the splendid achievements of the workmen's compensation principle in industrial injuries, and I recognize as well that since this has been proved to be a fundamentally sound program, the same principle should apply with equal force to the compensation of occupational disease. The point I wish to make is that we must be very sure that in its practical application the compensating of workers for occupational disease is confined absolutely to that, and is not broadened by legislation or by judicial interpretation to embrace diseases that are, in fact, not peculiarly inherent to the particular industrial activity involved.

It is very important, therefore, that the appalling ignorance that exist in medical circles at the present time as to the natures and causes of many of the true diseases of occupation be remedied. This can only be done by education; education in our undergraduate and graduate medical schools, through our medical societies, through symposia, through individual study of authoritative literature.

Laws compensating for occupational diseases should be very specific in their provisions as to just what particular diseases are to be covered and as well the particular industries in which those hazards exist. Final determination as to etiology, disability and prognosis for the purpose of awarding compensation should be in the hands of thoroughly competent, non-political boards of medical experts. The physician who is called into court as a witness should be perfectly sure of his facts before he testifies. Unfortunately, we see all too frequently physicians who are willing to draw far-reaching conclusions from very slender hypotheses. The trend of the times makes adjudicating bodies quite willing to extend the social influence of legislation of this kind as far as they can possibly do so with the medical testimony before them.

In meeting this newly created problem of occupational disease, and I assure you that the problem is one of enormous magnitude that threatens the very existence of certain industries, industry must have the intelligent cooperation of medicine. Since, moreover, medicine is fundamentally concerned with the whole program, it must be prepared to take an active part in its execution. We must recognize that in practically every instance the most important aspect of the occupational disease problem is prevention. This we must recognize as the fundamental task of the engineer and the chemist. The physician must be prepared to tell the engineer and the chemist what substances used in manufacturing are toxic, how they make their entrance into the body, how they leave the body, what they do to the body during their residence therein or their passage through. It is the function then of the engineer and the chemist, with the advice of the physician, to devise ways and means of isolating the offending material from the vulnerable zone of the worker. The problem extends even farther than that, for industry looks to the medical profession to tell it what substances are toxic before it discovers unfortunate things by unknowingly using its own workers as human guinea pigs.

All too frequently we learn that a given substance is inimical to health only through the trail of disease and death which it leaves. Before new substances which may be possibly toxic are introduced into manufacturing practice, full knowledge of their dangerous potentialities should be had, and complete methods for the prevention of resulting disease instituted. In both of these undertakings the medical profession must play a prime part.

Of particular interest to this group at the moment is the question of a fee schedule designed to secure adequate remuneration for the doctor in industrial cases. It is my conviction that fee schedules represent in general unsound practice, unfair to the doctor and unfair alike to the insurance company and the employer. It is all very well to buy onions or potatoes on a schedule basis, because the quantity and the quality can be easily standardized. This is not true of personal services. What may be a reasonable fee for one physician may be an exorbitant fee for another, and an inadequate fee for still a third. As a matter of fact, the significant aspect of the doctor's fee in work-

men's compensation cases is not the unit cost per service, but the quantity and efficiency of service. A doctor can make his fee pretty much what he wishes, regardless of a schedule if his conscience is a little lenient. A doctor too may be grossly underpaid in accordance with the schedule, if he is too efficient, if such a condition be possible.

I draw a sharp distinction between the trades and our profession, and I dislike to see that phase of trade unionism known as "wage scales" invading our ranks. "Wage scales" may be necessary in many labor relations, but until every other means has been exhausted, it is certainly not a procedure befitting the dignity of our calling. I believe it to be far better to continue the successful efforts of the past few years toward the education of industry and insurance on the one hand, and medicine on the other, as to mutual needs, mutual dependency, and mutual interest in the fundamental goal, which is the welfare of the worker. As conflicting points of view are reconciled by mutual efforts and education, as the enlightenment of both industry and medicine grows, these irksome economic problems will diminish. As each group realizes the need for the subordination of self to the greater benefit of the industrially injured, the exploitation of one group by the other, so often seen, will cease. And I assure you the exploitation is not confined to either group.

THE day of individualism in the practice of medicine is passing. The gradual development of group practice, insurance plans of one kind or another, the growing sentiment in governmental, lay and certain medical circles leaning toward socialization, all are straws which point the direction of the wind. The group of our society toward which all of this interest is directly concentrated is, actually or potentially, to be found in industry. It is the wage-earning group. It is the group which both consumes and produces, and in which the balance between production and consumption must largely be maintained.

Society then has a full right to demand of our profession a more ardent interest in the promotion of the health and safety of the industrial worker. For surely social and economic health are inseparably related to physical and mental health. We must answer that call which means so much for the betterment of society, even though as we enter Rome we must doff our old garments and don the garb of a Roman.

Post-Graduate Course in Industrial Hygiene

INDUSTRY today demands the services of physicians who are familiar with available knowledge of potential health hazards. Particular attention is focused on the field of industrial health problems at this time by both employers and employees in view of recent legislation concerning effects of occupations on health.

In sponsoring a short intensive course in industrial hygiene the committee on Graduate Education of the Allegheny County Medical Society in Pittsburgh is convinced that the present trend in the industrial health field makes it imperative that physicians with industrial contacts have a working knowledge of current problems in industry, not only as they relate to medicine but to engineering and law as well.

This course is designed to bring to the attention of the physician some of the most important subjects now confronting industrial management and the physician in industry.

Physicians should be cognizant of the wide field of industrial hygiene as they may be called upon to make recommendations in regard to protective measures for all occupational health hazards. *It is only proper that physicians assume this responsibility.*

The committee has endeavored to cover some of the most important problems in the field of industrial hygiene.

The threshold of knowledge relative to air pollution has only been approached.

Increased knowledge of physiological effects of materials and processes commonly used in industry, as well as the constant advances in industrial chemistry are making available many new products.

Knowledge of the physiological effects of heat is rapidly increasing.

The wide use of electricity demands increasing knowledge of its effects on the human body, and industry necessitates the continued study of the hazards in its use.

The study of human failure as the cause of accidents is worthy of continuous thought.

Courses of this type should develop a broader knowledge of potential or real hazards through providing additional incentive for the research work that is most necessary for the wider application of preventive medicine in industry.

Now is a most opportune time to present this course in the opinion of the Committee.

It will be given by the Department of Industrial Hygiene of the University of Pittsburgh, with classes scheduled daily from October 24 to October 28 inclusive. Excepting the final day, lectures will begin at nine o'clock in the morning and continue until evening.

All lectures will be held at the Medical School, University of Pittsburgh, Thackery and O'Hara Streets, Oakland, Pittsburgh. Lunch is included in the registration fee, and will be served at the University Club. Also buses for plant visits will be provided.

All registrations must be received by October 15, as the class is limited to 45 physicians. Out of town registrants may make reservations at the Schenley or Webster Hall Hotels which are convenient to the University.

Fee for the course is $50, of which $10 is payable at the time of registration and the balance at the start of the course.

Checks should be made payable to DR. E. W.

WILLETTS, Treasurer, Allegheny County Medical Society.

Following is the schedule for the five days:

Monday, October 24, 1938.

9:00—10:00 "Trends in Traumatic Surgery," WILLIAM O'NEILL SHERMAN, M.D., Chief Surgeon, Carnegie-Illinois Steel Company.

10:00—11:30 "Solvents and Chlorinated Compounds — Physiological Effects; Determination of Concentrations," HENRY F. SMYTH, JR., PH.D., Industrial Toxicology Department, Union Carbide Company.

11:30—12:30 "Solvents and Chlorinated Compounds — Diagnosis; Preventive Measures," WILLIAM B. FULTON, M.D., Director, Division of Industrial Hygiene, Department of Health, Commonwealth of Pennsylvania.

1:30— 2:30 "Electricity — Present Knowledge Physiological Effects; Systemic and Local Treatment of Electric Injuries," C. F. ENGEL, M.D., Assistant Medical Director, Westinghouse Electric & Manufacturing Company.

2:30— 3:30 "Heat Sickness — Physiological Effects; Symptoms; Treatment," MARLIN W. HEILMAN, M.D., Chief Surgeon, Allegheny Steel Company.

3:30— 4:30 "Mental Hygiene in Industry," C. H. HENNINGER, M.D., Professor of Psychiatry, School of Medicine, University of Pittsburgh.

4:30— 5:30 Discussion.

Tuesday, October 25, 1938.

9:00—10:00 "Dust Hazards — General Discussion; Classes of Dusts; Sources; Elimination," HARRY B. MELLER, Sc.D., Managing Director, Air Hygiene of America, Inc.

10:00—11:00 "Determination of Dusts — Concentration; Composition; Particle Size," CARLTON E. BROWN. Sc.D., U. S. Bureau of Mines.

11:00—12:00 "Non-Silicious Dusts and Dusts of Low Silica Content—Experimental Results; Application to Human Pathologic Changes; and Diagnosis," SAMUEL R. HAYTHORN, M.D., Director, Singer Memorial Laboratory, Allegheny General Hospital.

12:00—12:30 Discussion.

1:30— 2:30 "Silicosis, Asbestosis — Pathology; Diagnosis," SAMUEL R. HAYTHORN, M.D., Director, Singer Memorial Laboratory, Allegheny General Hospital.

2:30— 3:30 "Silicosis, Asbestosis — From an X-ray Standpoint; X-ray Technique; Interpretations; Frequency of Re-examination," PAUL G. BOVARD, M.D., Consultant Roetgenologist, Pittsburgh Plate Glass Co.

3:30— 4:30 "Industrial Gases — Detection; Physiological Effects; Preventive Measures," WILLIAM P. YANT, B.S., Director, Research and Development, Mine Safety Appliance Co.

4:30— 5:00 Discussion.

Wednesday, October 26, 1938.

9:00—10:00 "Lead—Absorption; Distribution; Elimination and Symptomology in the Human Body," ROBERT A. KEHOE, M.D., Associate Professor of Physiology, University of Cincinnati.

10:00—11:00 "Sources of Lead Poisoning — Determination of Concentrations; Preventive Measures," JOHN B. LITTLEFIELD, A.B., Research Chemist, Mine Safety Appliance Company.

11:00—12:00 "Lead — Clinical and Laboratory Methods of Diagnosis and Treatment," ROBERT A. KEHOE, M.D., Associate Professor of Physiology, University of Cincinnati.

12:00—12:30 Discussion.

1:30— 2:30 "Mercury; Manganese — Physiological Effects; Pathology; Prophylaxis; Zinc; Chromium; Cadmium; Selenium," ROY R. JONES, Surgeon, Division of Industrial Hygiene, National Institute of Health.

2:30— 3:30 "Mercury; Manganese—Sources; Method of Determination; Zinc; Chromium; Cadmium; Selenium," FRANK R. HOLDEN, PH.D., Industrial Hygienist, Pittsburgh, Pa.

3:30— 4:30 "Mercury; Manganese — Clinical and Laboratory Methods of Diagnosis and Treatment; Zinc; Chromium; Cadmium; Selenium," ROY R. JONES, Surgeon, Division of Industrial Hygiene, National Institute of Health.

4:30— 5:00 Discussion.

Thursday, October 27, 1938.

9:00—10:00 "Electric Welding — Hazards; Elimination, Physiological Effects," CHARLES S. STEPHENSON, Commander, Medical Corps, U. S. N., in Charge, Division of Preventive Medicine.

10:00—11:30 "Dermatoses—Industrial Causes; Diagnosis; Treatment," V. H. GUY, M.D., Professor of Dermatology, School of Medicine, University of Pittsburgh.

11:30—12:30 "Prevention of Dermatoses — Occupation Survey, Hygiene Measures; Good Housekeeping," EDGAR C. BARNES, B.S., Industrial Hygiene Engineer, Westinghouse Electric & Manufacturing Company.

1:30— 2:30 "Fatigue — Relation to Productivity, to Health, to Accidents," RUSSELL R. JONES, M.D., Medical Director, Bell Telephone Company of Pittsburgh.

2:30— 3:30 "Compensation Laws — Occupational Diseases," W. A. CHALLENER, JR., LL.D.

3:30— 4:30 "Medical Control of Occupational Health Hazards—Relation of Other Operating Departments; Responsibility of Physician," T. LYLE HAZLETT, M.D., Medical Director, Westinghouse Electric & Manufacturing Co.

Friday, October 28, 1938.

CARNEGIE-ILLINOIS STEEL COMPANY, Homestead, Pa.

9:00—11:00 (Group 1) Function of Industrial Medical Departments; pre-employment and periodic examinations; surgical and medical practices in plant dispensaries; medical and engineering equipment; administration—records, reports, etc.

1:00— 3:00 (Group 2)

3:00— 5:00

MINE SAFETY APPLIANCE COMPANY, Pittsburgh, Pa.

9:00—11:00 (Group 2) Manufacture of equipment for detection of gases, respiratory protection of workers; first aid supplies and other devices for protection of health and prevention of industrial accidents. There will be a demonstration of use and performance of this equipment.

1:00— 3:00 (Group 3)

3:00— 5:00 (Group 1)

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.

9:00—11:00 (Group 3) Function of Industrial Medical Departments; pre-employment and periodic examinations; surgical and medical practices in plant dispensaries; medical and engineering equipment; administration — records, reports, etc. Industrial Hygiene Laboratory.

1:00— 3:00 (Group 1)

3:00— 5:00 (Group 2)

The Industrial Physicians and Surgeons

—Still More of the Papers and Discussions, at the Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons, and Second Midwest Conference on Occupational Diseases, Chicago, June 6, 7, 8 and 9, 1938—

FOLLOWING, in the approximate order of their places on the Program, are more of the papers and discussions from the Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons and Second Midwest Conference on Occupational Diseases, at Chicago, June 6, 7, 8, and 9, 1938. The papers and discussions published in the July and August issues are so indicated in the full list by the references to the pages on which they appeared. Those included in this issue are designated by their page numbers in *italics*.

Monday, June 6.

UNDER the chairmanship of DR. C. O. SAPPINGTON, the following papers were presented:

"The Engineer's Place in Industrial Hygiene," by WARREN A. COOK, Supt. Engineering Dept., Zurich General Accident & Liability Insurance Company, Ltd. *(Page 551.)*

"The Insurance Company and the Control of Occupational Diseases," by J. B. LAMENZO, Research Engineer, Hartford Accident & Indemnity Company. (July, page 370.)

"The Physician's Responsibility in Industrial Hygiene," by C. D. SELBY, M.D., Medical Consultant, General Motors Corporation. (August, page 519.)

"Engineering Aspects of Problems in Industrial Epidemiology," by J. J. BLOOMFIELD, P. A. Sanitary Engineer, Division of Industrial Hygiene, U. S. Public Health Service. (July, page 377.)

"Plumbing as an Industrial Hygiene Problem," by MAJOR JOEL I. CONNOLLY, Assistant to the President, Chicago Board of Health. *(Page 555.)*

"Industrial Hygiene and the Nurse," by JOANNA M. JOHNSON, R. N., Supervisor of Nurses, Employers Mutuals, Wausau, Wisconsin. (July, page 385.)

AT THE evening meeting, at which DR. CAREY P. MCCORD presided, WILLIS H. CARRIER, Chairman of the Board, Carrier Corporation, read his paper on "Air Conditioning in Industry." *(Page 563.)*

Tuesday, June 7.

WITH DR. WM. D. MCNALLY as Chairman of the morning Session, and DR. ANDREW M. HARVEY presiding during the afternoon, the following presentations were made:

"Contact Dermatitis," by MICHAEL EBERT, M.D., Associate Professor of Dermatology, Rush Medical College. *(Page 559.)*

"Practical Problems Under Blanket Coverage for Occupational Diseases: A Review of the Illinois Claim Experience," by CLARK BRIDGES, Casualty Mutual Insurance Company. (July, page 390.)

"Noise in Industry," by ROBERT LINDAHL, the Celotex Company.

"Developments in Occupational Diseases Legislation," by OLIVER G. BROWNE, General Claims Attorney, New York Central System. (July, 394.)

"Women in Industry," by M. H. KRONENBERG, M.D., Chief of Division and Industrial Medical Supervisor, State of Illinois Department of Public Health. *(Page 569.)*

"Light, Vision, and Seeing," by MATTHEW LUCKIESH, D.Sc., Director, and FRANK K. MOSS, Physicist, Lighting Research Laboratory, General Electric Company.

"Tuberculosis and Its Relation to Silicosis," by O. A. SANDER, M.D. (July, page 399.)

"The Employability of the Silicotic," by VOYTA WRABETZ, Chairman, Industrial Commission of Wisconsin. (July, page 405.)

Wednesday, June 8.

THE Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons was opened officially by the President's Address of DR. ROYD R. SAYERS. (July, 410.)

DR. FREDERICK W. SLOBE was Chairman during the morning, and DR. CASSIUS H. WATSON presided, during the afternoon, while the program prepared and presented by the Association for the Advancement of Industrial Medicine and Surgery—which began with DR. CURRENCE's paper—was given.

The morning program was as follows:

"Hazards of Night Driving," by HART E. FISHER, M.D., F.A.C.S., Medical Director, Chicago Rapid Transit Company. (August, page 522.)

"Factors Determining Reasonable and Equitable Temporary Total Disability Periods," by PHILIP H. KREUSCHER, M.D., F.A.C.S., Chief Surgeon, Chicago Area, Carnegie-Illinois Steel Corporation; Former Medical Director, Industrial Commission of Illinois. (August, page 525.)

"The Occupational Diseases Research Department of Northwestern University," by FRED FITZ, M.D., Northwestern University Medical School. *(Page 576.)*

"Syphilis in Industry," by HAROLD A. VONACHEN, M.D., Medical Director, Caterpillar Tractor Company. (July, page 416.)

The afternoon program included:

"Arthritis in Industry," JOHN D. CURRENCE, M.D. *(Page 578.)*

"Tuberculosis in Industry," by GEORGE G. ORNSTEIN, M.D., F.A.C.P. (July, page 419.)

"Intra-Articular Damage," by WILLIS W. LASHER, M.D., F.A.C.S.

"Lead Poisoning in Industry," by IRVING GRAY, M.D., F.A.C.P.

THE Annual Banquet, with DR. WILLIAM A. SAWYER presiding, featured the paper by HARVEY G. ELLERD, Personnel Director of Armour and Company, on "Employability of Persons Presenting Disability or Disease." (July, page 430.)

Thursday, June 9.

WITH DR. C. D. SELBY, as Chairman, the program of the Institute of Traumatic Surgery was as follows:

"Discussion of Fat Embolism," by CARLO S. SCUDERI, M.D., F.A.C.S. (July, page 436.)

"Trauma to Blood Vessels, and Their Sequelae," by RAYMOND W. MCNEALY, M.D., F.A.C.S.

"Distinction Between Injuries of Spine, Spondylitis, and Spondylosis," by JOHN D. ELLIS, M.D., F.A.C.S.

"Pectin in the Treatment of Wounds," by JAMES E. M. THOMSON, M.D., F.A.C.S. (July, page 441.)

"Metallic Fixation of Bones," WILL T. LYON, M.D.

In the afternoon the Chicago Regional Fracture Committee of the American College of Surgeons, with DR. E. C. HOLMBLAD as Chairman, gave the following symposium:

"Fracture of the Carpal Navicular Bone," by KELLOGG SPEED, M.D., F.A.C.S.

"Prevention vs. Cure in Deformity Following Fracture," by PAUL B. MAGNUSON, M.D., F.A.C.S.

"March Foot," by DEAN L. RIDER, M.D.

"Treatment of Fractures of the Neck of the Femur by Pinning," by WILLIS J. POTTS, M.D., F.A.C.S.

"Treatment of Fractures of the Neck of the Femur," by HUGH MCKENNA, M.D., F.A.C.S.

The Engineer's Place in Industrial Hygiene

WARREN A. COOK,
Superintendent, Engineering Department,
Zurich General Accident and Liability
Insurance Company, Ltd.,
Chicago

IT HAS been stated that industrial hygiene is essentially the sphere of the industrial physician and that the engineer has little place in the control of occupational diseases. It has also been stated that if the industrial engineer does his job of controlling occupational diseases successfully by such methods as ventilation, enclosures and the rest, there will be no need for the industrial physician because there will be no exposures to cause injury to health.

My position, however, is that there is need both for the industrial physician and for the engineer in this work of occupational disease control. Each can supplement the activity of the other, and it is only with the joint activity of the two groups that control can really be effected.

In discussing the part of the engineer in industrial hygiene, it is necessary first to define the type of engineer we have in mind. The plant engineer is the one closest to the problem of occupational disease control and it is largely to him that I am referring in this paper. Engineers acting as consultants in occupational disease control, such as those attached to state bureaus and insurance company engineering departments, also have real parts to play. But it is the engineer who comes in contact with occupational disease control as an incident to his work and whose major function is that of plant layout, production, and maintenance, who is the principal concern of this discussion.

Our audience here this morning is composed of several types: many of you are industrial physicians—some of you are actively connected with control of occupational diseases; we also have those who are engaged in occupational disease control in the consultant and regulatory phases, both physicians and engineers; and presumably to a much lesser extent, the very group for whom this paper is prepared, the plant engineers.

In order to make the suggestions presented in this paper of practical value, it is my plea that you transmit the five general fundamentals presented in this paper to the engineers in plants with which you come in contact. The application of these fundamentals will, I trust, measurably assist in occupational disease control.

AS THE first fundamental step for the plant engineer, he should establish a firm and close contact with an industrial physician who has a sound appreciation of occupational disease conditions and of the extent to which exposure may cause injury to health. If such a physician is directly attached to the plant, so much the better. If an industrial surgeon is merely on call at the plant to take care of injuries, it is very possible that the plant engineer must have available to him some of the consulting group for accurate information and interpretation of it in terms of his own plant conditions.

It is to be emphasized that the engineer should know not only that certain materials may cause injury to health; he should also be informed concerning the relative severity of the hazard.

He should not be told, for example: "Since lead is being used in the plant, there is necessarily a lead poisoning hazard and, if possible, some other material must be substituted." The discussion the well-informed industrial physician should give the plant engineer is, depending on the conditions, either that lead is being used in such a way that further control measures should be instituted, or that possibly the exposure is sufficiently slight that there need be no apprehension concerning it.

Many of us have experienced occasions when anilin dyes may have been used or possibly small amounts of benzol, and the mere presence of the material caused a scare, whereas the extent to

which such material was being used or the exposure to it was so slight that there was no cause for alarm.

As an example of what may happen when the plant engineer has no contact with any source of information on health hazards, may I cite an instance of the installation of a new process in an electrical goods manufacturing plant. In this plant of fair size, the accident situation was well under control and only occasionally was it necessary for an industrial surgeon to visit the plant. He had not come in contact to any great extent with occupational disease hazards. The plant was largely one of machine operations, and there was no occasion for him to become informed in this field.

A new process was installed which involved not only laying out mechanical operations but included the use of a ceramic operation as well. The technique of doing this work had been brought to the plant by a foreman who had learned it in another plant. No special precaution was suggested by him to the plant engineer who laid out the operation very capably.

After several months, two or three of the girls engaged in this operation began to complain of abdominal symptoms. The family physicians who were consulted believed that these might be cases of lead poisoning, but on inquiring at the plant they were informed lead was not used. If lead were used in this mixture, the foreman stated, it would cause some wires to short-circuit and from the point of view of the product itself, no lead could be included.

Several days went by and other girls in the department developed similar symptoms. Consultation with men familiar with occupational disease hazards immediately disclosed the frit as the source of the lead. Analysis of the frit showed it to be essentially a lead carbonate, about 60% lead. The foreman and the engineer knew only that the operation worked. They did not realize that lead might be present in some other form than the metal which they knew must be absent.

In this case, as soon as the plant engineer was informed of the hazard involved in the operation, he introduced effective control measures and the cases ceased. Had he been informed of the hazard prior to the original layout of the operation, he would have had no difficulty in taking care of it without the development of the cases. This illustrates what can happen where the engineer does not have contact with a well qualified industrial physician.

AS A second fundamental, the plant engineer should have available to him a list showing all the materials used or any product which may be evolved from an operation and including an indication of the severity of the exposure. A chart can well be prepared showing the potentially hazardous materials along the abscissa and the departments in which they may be used on the ordinate. A number of plants have prepared such a chart. A symbol could then be inserted to indicate the probable severity of exposure to any of the materials in each of the departments.

At the Connecticut State Department of Health, we developed a chart of this type, but rather than listing along the ordinate the individual departments of the plant, we listed the various industrial classifications. I think possibly many of you have seen this chart. It was developed some two or three years ago.

The symbols to be inserted at the intersection of the injurious material with the department where it is present may well indicate three degrees of severity:

First, that the potentially injurious material is present but the exposure to it is negligible. In such a case, we need only be concerned with possible increase in exposure.

Second, that the exposure to the injurious material is of questionable severity. It has been my good fortune during the last ten or twelve years to have available methods for determining by chemical and physical analysis whether a material is present in sufficient concentration to cause injury to health. Without such information it is often difficult to judge whether or not an operation is presenting a hazard. To make a decision which will occasion a large expenditure without special determinations showing that such expenditure is justified is, in many cases, a precedure of questionable economy.

As will be brought out later, I believe it is desirable where possible to have information on the amount of injurious material in the air in connection with all the exposures where the severity is uncertain.

Third, that exposure is known or assumed to be causing actual injury to health. The symbol for such a condition may well be inserted in red. The plant engineer should be actively at work on any such condition. If some time is required to reduce exposures to safe limits, then he should see to it that workers are in the meantime properly protected, possibly by personal respiratory protection, until adequate safeguards have been engineered and installed.

Where the exposure is of questionable severity and control measures are suggested just to be on the safe side, the best interests of health are not always being furthered, for there is no more difficult plant in which to control conditions than that plant where money has been needlessly spent to remove some material which someone suspected to be hazardous but which later was demonstrated to be definitely safe.

On the other hand, it is dangerous to assume that any questionable exposure is safe merely because cases of occupational disease have not occurred. We have heard more of late about the carbon disulfide exposures in viscose rayon manufacturing operations. Gordy and Trumper, in Philadelphia, have been doing much investigational work in this industry.

Their paper, published in the *Journal of the American Medical Association,* (May 7, 1938), indicated that symptoms of carbon disulfide poisoning

had appeared among workers in operations as remote from the introduction of carbon disulfide into the viscose operation as those in the textile departments. It had always been our assumption that once the rayon had been washed, we need have no apprehension of carbon disulfide exposure. Determinations of carbon disulfide concentrations are being made at these operations of the viscose rayon industry to learn just what exposure they present.

In the same industry, an unexpected carbon disulphide hazard was disclosed by air analyses. It happened that the transfer of the carbon disulfide from 50-gallon drums in which it was received to the underground tank was made in the yard. One day each week, three or four of the workers would roll the drums up a ramp, remove the bung, insert an air inlet fitting, and let the carbon disulfide splash out into a funnel, from which it flowed into the underground tank.

These workers had been complaining of mild symptoms, chiefly headache and anorexia. Although it was thought that the complaints were largely the result of a dislike for the obnoxious odor of the material, a number of air samples were collected for analysis, while the barrel was being emptied. To our surprise, even though the samples were taken on a comparatively warm February day, the concentration of carbon disulfide on the windward side of the operation was some 600 parts per million of air, and about 1200 parts per million on the leeward side.

These concentrations, of course, were present only for a comparatively short time during the operation, the wind soon dissipating them, depending on atmospheric conditions. However, such concentrations were being inhaled by the workers for several minutes at a time repeatedly throughout the day and the exposure was repeated once a week.

Once definite information was received concerning the actual severity of the exposure on the basis of these determinations, a very effective measure for controlling the situation was instituted by merely purchasing the carbon disulphide by tank car and running it through a closed system to the underground tank.

It was rather gratifying to learn later that an appreciable saving in carbon disulfide in pounds per pound of the finished rayon had been effected, further indicated than very large amount of carbon disulfide vapor was lost during this transfer operation. So, we had a saving both in the material itself and also in the labor involved in handling it, to say nothing of the possibility of added cost to the manufacturer if the exposure had caused acutal disability.

THE third general suggestion to the engineer is that he be informed of resources available to assist him in determining conditions which should be given attention. I have mentioned determination of concentration of injurious material in the air. There are a number of other resources of which the engineer can avail himself if he is to handle this problem effectively.

Results of epidemiological investigations are of much value. For example, there is the foundry study which has recently been completed by the New York State Division of Industrial Hygiene, and the Massachusetts foundry study which was completed in 1934. Such epidemiological studies, which give the percentages of workers who show evidences of injury to health when they are engaged in various operations are a real guide in indicating to the plant engineer whether he should utilize control measures in similar operations in his plant.

In the United States Public Health Service's mercury poisoning study in the hatters' fur-cutting industry, it was found that varying percentages of workers developed symptoms of mercury poisoning depending on the department in which they worked. On the basis of that study, the engineer would have good ground for reducing the concentrations to which the workers are exposed in certain of the departments based on a comparison of conditions reported in the study with those in his own plant.

At the present time, the plant engineer has available a number of consultants in this field. Many, in fact most, of the industrial states have Bureaus of Occupational Diseases to which the plant engineer may refer for assistance in solving his problems. Insurance companies maintain engineering department staffs which are available for consultation and assistance in taking care of these exposures. University departments of industrial hygiene and occupational disease and private industrial hygiene consultants are also available to carry on this work.

Other resources at the disposal of the plant engineer are physiological tests, x-rays, physical examinations. These particular functions are, of course, in the field of the industrial physician, but if the industrial physician places in the hands of the engineer the results of the physiological tests, that engineer has a firmer basis for instituting control of potential hazards.

When any cases of occupational disease occur, the engineer should lose no time in applying further control measures in those departments. This it, however, an unfortunate criterion as it indicates that the condition has been allowed to exist too long before being spotted and corrected.

Sometimes this criterion must serve, particularly where there has been no prior intimation that a given condition would cause injury. Such a case occurred in a group of textile manufacturing operations where formaldehyde was being used in very greatly increased quantities and in such a manner that the formaldehyde saturated fabric was being heated to rather a high temperature, causing evolutions of large amounts of the gas. Formaldehyde has of course been used in many operations, particularly in synthetic resin manufacturing, and it was believed that its irritating odor served as its own safeguard in preventing excessive exposure. But in this textile operation, the exposure was particularly severe and of long duration. Very serious injury to health resulted. To be sure, the

most severe cases occurred in workers who had been known to be in poor health. But one worker who was shown to have been in good health was also affected.

No time was lost in effecting very complete control of these operations by enclosures, ventilation and provision of hand-holds so the worker could manipulate the fabric from outside the enclosure. Where, occasionally, it was necessary for the workers to enter enclosures, gas masks were provided. After the first group of cases, no further ill effects were experienced.

Finally, good industrial practice should serve as a guide in engineering control measures. The engineer knows what is meant by "good industrial practice," and we should not lose sight of the fact that, in many instances, good industrial practice serves as a good criterion and should always enter the consideration of control measures.

AS A fourth fundamental, the engineer should avail himself of certain aids in developing economic and effective methods of control. Neither one of these two elements is to be slighted. Effectiveness and economy are both essential.

Among the aids that are available are such codes as the exhaust ventilation, handbook and code recently published by the American Foundrymen's Association. Although this handbook was developed by a committee of the foundry association, there is no question but that in any other plants where injurious materials are disseminated into the atmosphere, the plant engineer should have a copy of this code.

The full report of the engineering committee of the National Silicosis Conference is to be published shortly, and though this report is more general in nature than the A.F.A. code, the general suggestions which it includes are of value in giving the engineer a broad background of the various methods of controlling injurious conditions.

The American Standards Association codes should also be referred to. State regulatory codes are being developed in greater numbers. The plant engineer should be informed of such sources as the United States Public Health Service and the United States Bureau of Mines. The engineer may know very little of the latest information on respirators such as is published by the Air Hygiene Foundation and you industrial physicians should keep him informed.

Technical trade journals are excellent sources of information which should be brought to the plant engineer's attention. He is undoubtedly familiar with those which treat his industry, but papers which you note on engineering phases of occupational disease control in such journals as that of *Industrial Hygiene and Toxicology*, which he ordinarily would not see, you should most certainly bring to his attention.

THE final principle, if the engineer is to assume his place in industrial hygiene, is that he must assume a responsibility for maintaining good working environment and healthful conditions. If a new process is to be instituted or old process to be changed, he should ascertain that no injury to health will result from such new conditions. Where control measures have been inaugurated, he should ascertain whether they are effective on the basis of air analysis, physiological tests, x-rays, or physical examinations with which you will be in position to assist hm.

In order for an engineer to observe these five fundamental essentials in industrial hygiene, it is necessary that he avail himself of all the assistance that the industrial physician has to offer him.

May I urge, in concluding, that you cooperate with the plant engineer to the fullest extent; that you supply him with information concerning the sources available to him which may have come to your attention in such conferences as this. Accept as part of your responsibility as an industrial physician the assistance of the plant engineer with whom you may come in contact and help him to assume in full his part in industrial hygiene.

Discussion:

DR. H. H. SCHRENK (Chief Chemist, Health Division, U. S. Bureau of Mines, Pittsburgh): The primary object in the field of industrial hygiene is to prevent injurious exposure. Our efforts along this line are based on one assumption—or we may consider it a fact—and that is that the human body can detoxify, destroy, eliminate, or otherwise handle a certain amount of any material without any measurable damage. Our problem, therefore, is so to control the environmental condition that harmful amounts of contaminants are not present under conditions that will permit their contact with or absorption into the body.

Mr. Cook has described to you what can be accomplished by proper control procedures, covering the subject so well that I shall only attempt to emphasize one or two points. First of all, one must know what materials are being used, and not only that, but also under what conditions. Frequently we state that a substance will not produce a hazard because it has a high boiling point or a low vapor pressure. However, we must know under what conditions it is being employed.

After obtaining a complete list of materials, the job is only half done A very strict check should be kept on the introduction of any new materials. Furthermore, the operations that are carried on in the plant should be studied. Frequently contaminants are produced by an operation, such as welding, or secondary products may be produced from the decomposition of hydrocarbons. This part of the job can be accomplished; that is, we can prepare a list of the compounds that are used and study the conditions under which they are used.

The second job is a little more difficult. It is to determine whether or not these compounds are being used properly, so that they will not produce injury. A partial answer to this problem can be obtained by an analysis of the contaminants in the air and correlation of this data with experience and toxiological information.

Unfortunately, our experience frequently is limited and the toxiological data available are inadequate. However, even under these conditions, much can be accomplished on the basis of good housekeeping and common sense procedures. On the other hand, though we have fairly complete information available, this information may not suffice, owing to daily and seasonal variations. Both in regard to concentration of contaminants and duration of exposure, it may be difficult to estimate the over-all exposures.

Again, pathological conditions, such as cirrhosis of the liver, fatty degeneration of the heart, lung diseases, etc., may exist and, therefore change the course of the normal action of the compounds under the conditions of exposure.

Tolerance might be developed, or hypersusceptibility might be present.

Thus in the final analysis it is up to the physician to ascertain whether or not the control measures have been satisfactory, because, regardless of what the findings are as to air analysis, if the man develops poisoning, they have not been adequate.

Looking a little toward the future, it seems to me that much can be accomplished in the engineering field by designing equipment with the item of occupational disease control as one of the important specifications. In other words, when a piece of apparatus or some equipment is planned, it should be designed not only with the idea of accomplishing its mechanical job but also with the idea of preventing an injurious exposure.

I stated previously that, in the final analysis, it is up to the physician to ascertain whether or not the exposure has been injurious. If he is to answer this question, the more information he can have on the effects of the various substances, the easier his job will be. We should have better methods of diagnosis, and especially early diagnosis. We want to find out whether an injury is being produced before it actually happens.

It seems to me that here, again, is a field which should be gone into more thoroughly. If we have methods of measuring exposure based on the physiological response of the person who is being exposed, possibly we can diagnose or establish the exposure before any injury is produced. Obviously, that would be the ideal procedure.

Briefly, then, our object is to prevent injurious exposure. There is no question that the engineer can design equipment to prevent injurious exposure providing we place at his disposal means of measuring it so that he will know when he has accomplished his objective.

Plumbing as an Industrial Hygiene Problem

MAJOR JOEL I. CONNOLLY, M.S.,
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IN THE broad field of industrial sanitation, hazards to health and safety presented by faulty plumbing are frequently given relatively scant attention by the sanitarian. This condition is the outgrowth of a tendency to slight questions of communicable disease in comparison with industrial poisonings. As a matter of fact, I believe that there have been more cases of illness among industrial employees in many cities, including Chicago, resulting from defective plumbing than from any other one industrial source in recent years. The reason is because the contamination of the water supply through a plumbing cross-connection is likely to affect adversely the health of every employee in the plant, whereas, in most plants, the number of employees exposed to great danger from poisoning is usually only a small fraction of the total personnel.

Water which is safe for drinking purposes is more or less difficult to procure, and certain expenses are entailed in securing and delivering it to the ultimate consumer. Therefore, factories frequently find that it is cheaper for them to pump directly from a nearby stream or lake for industrial purposes and fire protection than to purchase water from a safe source, such as a public supply. The uses to which this auxiliary, unsafe supply are put may be extremely numerous and varied. One of the principal uses is for cooling purposes, either in condensers of ice-machines, or in jackets around certain types of equipment. Other uses are for fire protection, sprinkling grounds, air conditioning, hydraulic presses, etc.

The location of the plant has a bearing upon the extent of the hazard from bad plumbing in it. For example, an industry located adjacent to salt water is less likely to have trouble from this source than one situated upon the shore of a fresh-water stream or lake, because a cross-connection with pipes carrying salt water is more readily discovered by taste. Going a step farther, it should be recognized that an industry situated beside a highly-contaminated river is exposed to a greater hazard from improper plumbing connections to an auxiliary water supply than one on the shore of a comparatively pure lake or stream.

It is not necessary to have an auxiliary water supply to have dangerous plumbing. Every building having both water and sewer pipes has an opportunity for trouble.

The Chicago amebic dysentery outbreak of 1933 caused the illness not only of a considerable number of guests in two hotels associated with the outbreak, but a majority of the employees in the hotels were also infected. That epidemic was attributed to two closely-related factors, both involving the overloading of a sewer pipe. That sewer pipe had a leaking branch over a water storage tank where sewage might drip into the tank and contaminate the water. It also had a direct connection through the ice-machine condenser with the sewer, and there is sufficient evidence set forth in the official report of that epidemic[1] to show that both factors were involved.

Although that outbreak is the best known water-borne disease outbreak which has occurred recently in this city, there have been four others either shortly before or since, all four of them associated with industrial establishments. Brief mention of a few of the salient points may not be out of place here.

IN THE summer of 1933, about 300 employees were made sick in a certain factory (located on the north branch of the Chicago River), supplied with water from the river and from the city mains. The illness, characterized by diarrhea and violent vomiting, was caused by a cross-connection made between the two water systems by a disobedient workman, who failed to carry out the instructions of his superior officer in making certain changes in the piping system. Three days after this outbreak of illness occurred, the factory management discovered and removed the cross-connection. No report was made at the time to the Board of Health.

Some time later, when the outbreak came to the attention of the Board of Health, the factory management disclaimed any knowledge of the cross-connection and attributed the diarrhea and vomiting among their employees to a chemical poisoning, alleged to result from the decay of dead fish in a "dead-end" water main near the plant. However, one of the employees was stricken with typhoid fever about three weeks after the initial outbreak of illness, and died. With this evidence in its possession, the Board of Health again questioned the management and finally succeeded in getting the information about the former existence of the cross-connection coincidentally with the widespread development of the diarrhea and nausea.

In that case, it is reported that $2500 damages were paid to the widow of the victim of typhoid fever by the company. In addition, the company provided, at the request of the Board of Health, for the examination of specimens of feces and urine from all of its approximately 300 employees, as a result of which a considerable number of amebic dysentery carriers were discovered.

In December of the same year, a request received by the Board of Health for an examination of the water in another factory (this one situated on the south branch of the Chicago River) started an investigation, which revealed that in this plant there was also a widespread outbreak of disease, with symptoms of diarrhea and vomiting, involving practically the entire force of 375 employees. Here it was found that a screen in the river water intake had been replaced on Thanksgiving day and the succeeding three days. The engineer of the plant had made a cross-connection between the river-water system and the city water pipes, in order to have water for his boilers from the latter system in time to start up the plant on the Monday following Thanksgiving day, just in case the work on the river intake was not finished; the plant having been shut down in the interim.

When the river-water intake was finished, highly contaminated river water was pumped into the city water pipes in the building and every one who drank the water was made sick. Following this initial disturbance affecting practically all employees, there was one amebic dysentery and three typhoid fever cases among the workmen. Curiously, one boy who was "pinch-hitting" for his brother, (without the knowledge of the plant management but with the connivance of the lad's immediate superior), was one of the typhoid fever victims. The investigation of the case revealed the trick to which the brothers had resorted, in order that the one regularly employed might not lose any pay because of his absence from work.

Inasmuch as this plant manufactured a food product, the Board of Health, when it learned of the trouble, required the company to call back from its jobbers and distributors a large quantity of foodstuffs produced during the time the water was contaminated, and reprocess it, in order to assure its safety for human consumption.

In this case also the Board of Health required that the examination of specimens of feces and urine from all of the several hundred employees be made. This was done at the company's expense, in order to find, and put under treatment, any carriers of amebic dysentery, typhoid, and paratyphoid fever who might have been infected during the outbreak. Seventy-three amebic dysentery carriers were found among employees by this survey.

Thus it will be seen that it was necessary for the company to incur extra expense in three directions; first, compensation to the victims of the disease; second, the loss of customers' good will and the actual cost of reprocessing the food materials called back; and, third, the outlay entailed by the examination of the specimens of feces and urine which alone may amount to several thousand dollars, when all of the employees of so large a plant must be examined.

Still another example of disease attributable to bad plumbing occurred in a plant which had been shut down for a period and was reopened with a revival in the business of the company. The men who reopened the plant were not the ones who had operated it previously, and they were uninformed of the existence of a cross-connection between a river-water system (used for fire protection and sprinkling the grounds) and the city water pipes used for drinking and domestic purposes. The result was that contamination of the drinking water occurred and a number of cases of typhoid fever developed and a large number of persons were affected by severe diarrhea. Investigation by the Board of Health revealed to the new operators of the plant the presence of the cross-connection which was protected by a check valve. This check valve had developed a leak (as usually occurs after a time), and it was therefore no protection to the safety of the drinking water.

THE other outbreak, to which reference is here made, resulted from the Union Stock Yards fire in May, 1934, where fire engines were pumping from all available sources of water. There were in the Stock Yards at that time four water supplies of varying degrees of purity, though one has since been abandoned. First, the purest was the city public water supply. Then, second, there was a private deep well which was also reasonably safe. Third, some previously-used water was collected in a storage reservoir, in which the water was subjected to heavy contamination from drainage from cattle pens and runways. This used water was pumped to the pens. Lastly, there was a system which took water from a large intercepting sewer, filtered and chlorinated it, and the effluent was used for washing the pens, sprinkling the hogs to keep them cool on hot days, and similar uses. This one is no longer used. Under the emergency conditions produced by the fire, the supply of water to the chlorinator in this purification plant failed because the water in the reservoir was drawn down until the pumps supplying the chlorinators lost their suction.

Owing to the failure of these pumps, the chlorinator naturally also failed and filtered sewage without chlorination was forced into the pipes from which many of the fire engines were drawing water. At the height of the conflagration, it appears that the filters themselves were by-passed and straight, untreated sewage was used by the fire engines.

Employees in the Stock Yards were acquainted with the hazard of drinking from these two impure auxiliary water supplies from the sewer and the reservoir, respectively. However, most of the fire-fighting equipment of the city was rushed to the fire, which rapidly spread.

In addition to the hundreds of firemen thus brought into the Stock Yards, there were thousands of spectators lured by the fire. People hearing exaggerated radio reports that the entire section of the city from the Stock Yards to the Lake was doomed to destruction drove to Chicago, many of them from cities as much as 150 miles away, to witness the conflagration. Needless to say, the firemen and the spectators were unacquainted with the hazards of the auxiliary water supplies and, in the intense heat, they drank freely in the belief that all of the water was safe. The tragic results show how badly mistaken they were. Sixty-nine cases of typhoid fever and 11 deaths occurred, in addition to a number of cases, and one death, from amebic dysentery.

Recently typhoid fever has developed in the son of one of the firemen who was infected with typhoid fever at the fire, and this fireman, upon reexamination, has now been found to be a carrier.

The lesson, to be learned from this recital of actual occurrences, is that there is grave danger in industrial establishments where pollution of the water system may occur, either through cross-connection with impure water supplies or through connections of water pipes with sewers, or even by failure to discern the danger in an unfamiliar water supply.

Recently, in a silver-plating establishment in one of our largest office buildings, a cyanide tank having a submerged water supply inlet was discovered by one of our plumbing inspectors. Had the pressure in the water pipes fallen below atmospheric pressure, it was entirely possible that a deadly poison—potassium cyanide—might have been siphoned into the drinking water system in this building which daily houses 30,000 workers. Fortunately the situation was discovered by the Board of Health and corrected before any harm was done. The lesson should not be lost that such submerged water inlets into fixtures likely to contain poisonous substances or human excreta are potential hazards.

IT IS not the purpose of this paper to enumerate all of the different kinds of cross-connections which are found from time to time in industrial plants, for that would take far more time than is available. It may not be amiss, however, to invite attention to the fact that air-conditioning apparatus is frequently associated with cross-connections between water pipes and sewers. In such equipment, there is frequently a circulating pump which draws water from the pan and sends it through the spray nozzles to wash the air. Occasionally the city water pipes are also connected to the discharge pipe of the pump so that city pressure may be used on the spray nozzles, if desired, instead of operating the pump. This arrangement is objectionable because dirty water from the air-washer pan below the spray nozzles (possibly containing some sewage) may be pumped into the drinking water pipes.

Such dangerous conditions are often found, not only in ordinary air-conditioning equipment, but also in special washers used to remove fumes and dusts from the air exhausted from spray booths and other locations where dusty trades are carried on.

A water closet equipped with a flush valve is one type of submerged inlet fixture. Water contamination by siphonage from toilets through flush valves is a possibility wherever the flush valves are not adequately protected against back flow. Combinations of vacuum breakers and check valves have been devised for giving a considerable measure of protection and are commercially available. Complete protection, however, is more certain where a definite air gap exists between the water pipe and fixture, and in most fixtures such a gap is the most logical and fool-proof safeguard to employ.

TO PREVENT hazardous plumbing conditions in industrial plants, several things should be done:

1. The detailed plans of the plumbing should be approved by the health department before the plant is constructed, and whenever any changes, renewals, alterations, additions, or removal of plumbing equipment, are performed. Inspections should be made by well trained men to assure that the approved plans are actually followed.

2. Wherever there is an auxiliary source of water supply, of doubtful safety, or wherever water is re-used (as in an air-conditioning or other circulating system), the pure-water piping should be painted a wholly different color from the auxiliary water supply piping, or the re-used water supply piping.

3. In all buildings where an auxiliary water supply of uncertain quality is available, measures should be taken to assure that even the city water in the plant is not permitted to return to the public mains in the street. This end may be accomplished by having the city main discharge into a surge tank from which the plant pump takes its suction. This comment applies also to a building so situated that a fireboat or fire engine drawing water from a contaminated source could deliver water into the standpipe connections of the building, even though such building has no permanent auxiliary water supply. I refer to such buildings, for example, as those along a river bank which have "Siamese" connections on the outside of the building, where river water might be pumped into

the plumbing system of the building by a fireboat in the river, or a fire engine on the bank taking its suction from the river.

4. Periodic reinspections of the plumbing should be made from time to time by thoroughly competent inspectors, to guard against the creation, either through accident or ignorance, of new hazardous conditions in a plumbing system which was safe originally. This practice permits detection and correction of such conditions as the cyanide tank referred to above. The frequency of the reinspections should be based upon experience with the plant and the degree of cooperation displayed by its management with the health authorities.

5. Plumbing work should be done by a licensed plumber who was required to demonstrate his competence and recognition of health aspects of plumbing in order to receive his license.

6. The medical department of a plant should carry on a campaign of education to guard against the drinking of water from fixtures other than approved drinking fountains, particularly where auxiliary unsafe water supplies are available in the premises. Signs warning against drinking from sources other than drinking fountains should be posted in well-lighted locations and, if workmen unfamiliar with English are employed, the signs should be in languages which can be read by them. The drinking water should be cooled to a temperature of between 45° and 50° Fahrenheit, as a further inducement to use the drinking fountains. The latter should meet the standards adopted by the American Public Health Association.[2]

7. Surge tanks, pumps, filters, cooling tanks, and similar apparatus used in connection with the drinking water should be located where they will not be subject to accidental flooding, or exposed to contamination by leakage from pipes passing above them conveying an impure water supply or sewage. They should not be directly connected with a sewer lest sewage back up into them when the sewer is flooded or obstructed.

8. There are certain peculiar hazards in the plumbing connections of special hospital equipment such as water sterilizers, autoclaves and bedpan sterilizers, which are not encountered in other buildings. Therefore, if an industrial plant maintains a hospital, special attention should be given to this matter.

9. Although practically all states, and most cities, forbid plumbing cross-connections by law, the fact that these cross-connections are frequently the source of disease (as shown by a report on outbreaks of water-borne disease in the United States and Canada)[3] is sufficient indication that the law is not sufficiently obeyed. To secure better compliance with the law and greater safety to employees, any change in the plumbing system in a plant should be made only at the direction of some designated official who is definitely charged with the responsibility of assuring that no hazard will occur as a result of the change. An order or plan bearing the signature of this official should be kept on file, in some appropriate place in the plant, for future reference. It would be desirable that this official be specially trained, possibly in cooperation with the Board of Health of the municipality, to recognize and guard against cross-connection hazards. Such a record is of great value in the investigation of outbreaks as well as in their prevention.

10. A feeling of mutual confidence and cooperation should be built up between the plant management and the health authorities in order that they may, first, prevent outbreaks of disease, and second, minimize their seriousness if they do occur. It should be remembered that the Board of Health will gladly assist in preventing trouble if the industry will but give it the opportunity to aid.

References:

1. "Epidemic Amebic Dysentery," National Institute of Health, Bulletin Number 166.

2. "Essential Features in the Design of Sanitary Drinking Fountains," Year Book, American Public Health Association 1930-1931, p. 135.

3. "Water-borne Outbreaks in the United States and Canada 1930-1936 and Their Significance," Year Book, American Public Health Association 1937-1938, p. 137.

Discussion:

DR. J. H. CHIVERS, Medical Director, Crane Co.: I wish to commend Major Connolly for his very able presentation of a problem that I think as industrial physicians we too frequently shift to a municipal or state health department and call it "their headache."

The problem of communicable diseases in an industrial establishment is not a great deal different from the problem in a municipality. I think we all recognize that industry is taking a greater degree of responsibility for the health and welfare of its employees. Whether we like it or not, the recent trends in legislation make the employer "his brother's keeper" and he must treat his employee like a brother.

A number of states are re-writing their codes and regulations pertaining to the health, welfare, and safety of employees. If you are at all interested in reviewing the existing regulations in many states as they pertain to sanitary fixtures and plumbing in industrial establishments you will be astounded at the ineffective provisions that are set up from the standpoint of hygiene, comfort, and decency. The re-writing of these codes should be a direct concern of industry and should not be left entirely to the labor department or some other governmental agency. In many details the problem is medical, and the industrial physician can contribute much worthwhile information in bringing these codes and regulations up to date.

Investigators and research work with particular reference to communicable diseases have brought out some very worthwhile data pertaining to the part that plumbing fixtures play in the spread of these diseases. The pollution of drinking water through back-siphonage from water closets has resulted in radical changes in plumbing design and hook-up. The amount of research work that has been done on this one problem merely emphasizes the importance of it. In an investigation of the infantile paralysis epidemic that occurred sporadically throughout this country during the last two years, I know that a special inquiry was made of the possible relation that back-siphonage in plumbing fixtures had to the spread of this disease. The results of that phase of the inquiry were startling.

Bacteriological tests in many styles of drinking fountains have shown that they are not all that they are "cracked up" to be. Cultures of pneumococci, and hemolytic and green streptococci, from samples of water taken from the drinking fountains in one of our most modern hospitals during a "flu epidemic" has stimulated research and experimental work on this more modern sanitary fixture. I have recently watched some bac-

teriological tests of drinking water where a violet-ray plays on the water spout for 30 seconds after each use of the fountain. This inquiry may result in lowering the incidence of certain communicable diseases.

The complicated plumbing and piping systems of hospitals with their numerous special equipment and fixtures present many opportunities for contamination of the water supply by back-siphonage. Therapeutic baths, sterilizers, bed-pan washers, tanks, sinks, and closet bowls are potentially the most dangerous.

May I suggest that if you have two or more employees who develop typhoid fever, dysentery, poliomyelitis, or any communicable water-borne disease, don't pass the entire responsibility on to your public health department. Start your own inquiry into tne condition of your plumbing fixtures because I have an idea the health department will soon be asking some very embarrassing questions.

MR. G. O. PIERCE (University of Minnesota): We all appreciate that conditions such as Major Connolly described are not unique in Chicago. The Department of Health of the State of Minnesota has been interested in the problem for a number of years and, as a matter of fact, we have had at least two epidemics caused by cross-connections between safe and unsafe water supplies in industries. As a result we have had a great deal of interest in the subject and have tried to accumulate all the information we could in a scientific way. For the last four years we have had studies in progress at the University of Minnesota, in cooperation with the Department of Hydraulics, on the very problem Major Connolly has discussed, and we have repeated a number of the experiments Major Connolly illustrated and, of course, have corroborated the information he obtained.

Moreover, when we made an investigation recently of a typhoid fever epidemic in one of our large cities, we took plumbing into account and made a rather thorough study of a number of typical buildings, including industries. The results of these investigations showed that we had practically all the different types of plumbing defects that Major Connolly mentioned, and that these defects could, under some conditions, operate to introduce a contamination into the drinking water supply.

In our study of the typical hotel, where there were a number of floors, we found that pressure conditions in the water supply line in the upper floors of the building were such that vacuums were produced on a number of occasions during a 24-hour period covered by the test and that these vacuums were of a degree which would cause back-slidage from a number of fixtures which were present. In one test, we found, I believe, 25 actual occurrences of vacuum in the 24-hour period on one fixture.

It is important that we remember the state health departments are not in a position to cover the subject of plumbing investigation, or plumbing survey, thoroughly in all the industries. I am glad this subject was included on the program, and I think the selection of Major Connolly as a speaker on the subject was a particularly fortunate choice.

The industrial physicians and surgeons in charge of occupational hygiene are certainly in a good position to carry out the work along the line of correction of plumbing defects in industry with the assistance — valuable assistance, I am sure — of the engineers who are responsible for the installation of control methods and who have an opportunity to observe these plumbing defects.

Contact Dermatitis

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IT WOULD be superfluous in a gathering of this character to urge the importance of contact dermatitis as a cause of disability in industry. C. Guy Lane[1] in a recent analysis of records of Massachusett's industry since 1925 has arrived at the significant conclusion that dermatitis accounts for 60% of compensable cases. Using home office records of England, Sir E. Graham Little,[2] found more than 50% of the compensable occupational diseases in Great Britain since 1918 were dermatitis.

Contact dermatitis in an industrial worker is an inflammatory reaction of the skin due to contact with some substance or combination of substances in the course of his industrial occupation. In recent publications with which you are familiar it has been frequently emphasized that there are two types of substances which may be the offending agents in producing dermatitis.

Type I—Direct Irritants

SUCH substances as alkalies, acids, metal salts such as chrome, certain vegetable oils, certain chlorine compounds, many industrial solvents, hygroscopic agents such as concentrated sugar and salt solutions and a host of other substances, cause reactions in the majority of workers adequately exposed to them. Louis Schwartz[3] is of the opinion that such direct irritants cause the majority of cases of dermatitis in industry. Often the dermatitis so produced presents easily recognizable features, such as punctate ulcers due to chrome salts, the keratolysis due to alkalies, and so forth. The reaction occurs a very short time after sufficient exposure. There is no period of incubation.

Prosser White[4] in his fascinating volume on the occupational affections of the skin explains in great detail how the physical state of the irritant, whether it be in large masses or finely powdered, dry moist or in solution, may determine its potentiality as an irritant. He adds that the humidity, the temperature and the ventilation of the workroom may determine whether or not irritation is produced.

Type II—Allergenes

CERTAIN substances such as some plant oils, certain anilin dyes and dye-intermediates, some metal salts such as mercury, nickel, etc., and numerous organic substances used in industry produce dermatitis only in susceptible individuals and then only after a lapse of an incubation period, usually from four days to an indefinite period. To illustrate from the following clinical example, Osborne[5] found that when a new water-proofing preparation was furnished to linemen, splicing cables, no reaction appeared until the eighth day, then new examples appeared each following day. In this instance the minimum latent period was eight days and varied with the individual.

This type of dermatitis is now assumed to be an allergic reaction, an antigen-antibody type. The theory is that the metal, dye or oil acts as an allergen (antigen). Reagins (antibodies) are formed in the cells of the epidermis after a latent period. Subsequent contact with the allergen results in a combination of the allergen and the reagin forming a toxic substance, which causes the inflammatory reaction in the epidermis. The reagin is tissue bound and does not circulate. This accounts for the superiority of the patch test over the scratch test in this type of allergy. The patch test brings the allergen in contact with the epidermal cells to which the reagin is bound, while the scratch test brings the allergen in contact with the superficial blood vessels, which are not the shock-organ in this type of dermatitis.

At first the specific hypersensitivity may be limited to small areas of the skin, hence the necessity of applying the patch test near the site of the dermatitis.

Frequently, however, all the skin becomes allergic to the given allergen.

Some substances render allergic only a small proportion of those exposed to them, such as parared in the Sunday newspaper supplements. Others are more powerful, such as paraphenyldiamine, which produces a high percentage of allergy. Bloch[6] has shown that, given a concentrated extract and frequent applications, he was able to render 100% of his volunteers, including himself, sensitive to an ether extract of primula obconica (the common primrose). Thus persistent exposure to strong concentrations may eventually produce an allergic dermatitis even in the relatively non-susceptible.

Certain concomitant circumstances may break down the defensive barriers of the non-susceptible and produce allergy. The use of soaps and various other alkaline solutions may dissolve the keratin of the epidermis and the protective sebum in the follicular openings, thus permitting intimate contact between the allergen and the epidermal cells with a consequent sensitization of these cells. Grease solvents may accomplish the same effect by dissolving the protective oils and wax on the skin surface and follicular openings. Hyperidrosis (excessive sweating), whether it be functional or the result of high temperature and excessive humidity, washes away the oily surface protection, changes the pH of the skin and promotes the production of allergy.

Potential allergens suspended as dust in poorly ventilated shops are dissolved in the workers' sweat and thus brought into intimate contact with the epidermal cells, causing an allergy.

Trauma, due to working conditions and frictions which rub the potential allergens into the epidermis, is hard to reproduce in patch testing but is undoubtedly a very important factor. Burns and scalds may predispose the epidermis to subsequent sensitization. The wearing of clothing saturated with potential irritants is another source of breaking down skin immunity.

A contact dermatitis on any part of the body, due to some other cause, may sensitize the skin generally to the potential allergen in the occupation.

Persistent Industrial Dermatitis

THERE is a phase of this subject which has been impressed on me by my work in Cook County Hospital. It is the problem of the worker whose dermatitis fails to clear up permanently after discontinuing the occupation which has been apparently the irritating agent, or continues to recur with short intervals of freedom. This problem has a deeper implication than mere theoretical interest for it is involved in the determination of fair compensation.

Let us assemble some factors which a physician must consider in his endeavor to solve the problem.

I—THE INDIVIDUAL'S HISTORY: (a) It is well known that patients with congenital anomalies of the skin, as ichthyosis and xerosis, are better candidates for the development of industrial dermatoses than normal workers. Likewise, dermatitis once active in them is more difficult to allay. Response to treatment is slower and less satisfactory. Every candidate for work which is potentially irritating should be examined for such anomalies. If they are found, the worker should be rejected.

(b) Pre-existing seborrheic dermatitis strongly predisposes to contact dermatitis. All authorities seem agreed on this fact.

(c) Vasomotor disturbances predispose. Persons with chilblain circulation of the hands and feet, hands bluish and cold, often with damp, clammy palms (hyperidrosis) are recalcitrant in many instances to therapeutic measures even after removal of the irritant.

(d) Disturbances of the autonomic nervous system, indicated by spastic colitis, gastric ulcer, neuro-circulatory disturbances, may be a factor. In such individuals worry about compensation, fear of losing a position and other emotional stresses may tend to prolong the dermatitis or produce other forms which are difficult to differentiate.

(e) The pigmentary character of the worker may be of great importance. Louis Schwartz[7] has shown that, in the synthetic dye industry, heavily pigmented races, as negroes, are less liable to develop dermatitis in the grinding and mixing operations than lighter skinned individuals. Klauder and Brown[8] state that pigmentation offers protection against chemical irritants.

(f) *Atopy.* Coca[9] defines atopy as "certain clinical forms of human hypersensitiveness that do not occur in the lower animals and which are subject to hereditary influence." Atopic eczema, infantile eczema, hay fever and asthma are usually classed as atopic diseases, while vasomotor rhinitis, angioneurotic edema, chronic urticaria and migraine are classified as possibly atopic. The history of these diseases in the patient, siblings or antecedents is of great importance. A contact dermatitis, especially in a youthful worker, may precipitate an attack of latent atopic eczema, which may persist indefinitely. The dry lichenified character of this eruption and its predilection for flexor surfaces helps iden-

tify this entity. A history of this kind, or of other forms of hypersensitiveness, such as previous attacks of ivy poisoning and other varieties of contact dermatitis, physical allergies, drug idiosyncrasies, food idiosyncrasies, often indicates a susceptibility to contact dermatitis in an industrial worker. In these predisposed individuals polyvalent hypersensitivity may result from one or more attacks of contact dermatitis. Such patients do not recover when they are no longer exposed to the industrial irritant and have received ordinary treatment. Patch tests will show that they have developed a polyvalent sensitization. They are irritated by various other substances, which they contact in their ordinary routine of life. They have now developed a chronic eczema, which is persistent or continuously recurrent.

(g) Co-existing illnesses, such as diabetes, may aggravate or prolong an industrial dermatitis. Some authorities believe focal infections play a part in aggravating allergic conditions of the skin. Beerman[10] gives an excellent review of this angle of the subject.

(h) Finally, diet insufficient in quantity and lacking in variety, leading to a low grade avitaminosis or anemia, is an important factor in prolonging the dermatitis in many patients.

II—Improper Treatment: Theoretically, after removal of the irritant, bland soothing treatments should heal any case of contact dermatitis. However for many reasons, as I have stated, numerous cases prove resistant. The physician is tempted to use stronger applications, possibly with the view of combating an assumed pyogenic or fungus secondary infection, to stimulate sluggish healing or to counteract severe itching. Such preparations as and mercury ointments, sulphur ointment, salicylic acid, tar, phenol, menthol, etc., may act as primary irritants and prolong instead of relieving the dermatitis. These are useful remedies, but for their application the art of the dermatologist consists in the wise choice of time and pertinence.

And unless he is hospitalized the patient frequently confuses the picture by applying of his own accord one or more of the myriad proprietary remedies, so widely and cunningly advertised. Certainly improper treatment is a potent cause of prolonged disability.

May I mention at this moment that the pruritus, which is extremely severe in many cases, is best managed with mild sedatives, for continued scratching produces more dermatitis, and more dermatitis more scratching, a vicious circle.

III—Home Occupations: Prosser White[11] emphasizes the ill effects of soap and water on inflamed areas. Many of our patients persist in the use of soap and water. Others attempt to protect the hands by the use of rubber gloves, which macerate the skin and aggravate the condition. Although, nominally unemployed, they engage in home occupations involving the use of soap, cleaning powders, grease solvents, turpentine, paints, the handling of plants, insecticides and the like. Some of these contacts may aggrevate the original disorder or prove the source of new dermatitis.

IV—Premature Return to Work: In order to lessen compensation there is the temptation to certify the patient as fit to return to his employment before normal skin resistance has been restored. The result is renewed activity in the dermatitis in a more resistant form. Again, frequently the offending causal agent has not been properly identified and the return to work even in a changed position may result in severe recurrence. Such recurrences predispose to polyvalent sensitization.

V—Secondary Infections: The physician must be aware that a patient suffering from contact dermatitis may develop simultaneously other skin disorders, which bear no relation at all to his original condition. It may require keen diagnostic acumen to differentiate these from the original dermatitis. Psoriasis, lichen planus, parapsoriasis, multiform erythema, drug eruptions, dermatitis herpetiformis, pemphigus, etc., may require the services of a trained dermatologist for identification.

Since eruptions on the hands are common and notoriously difficult to identify, you may be interested in a brief discussion of several which often create confusion.

Ringworm infections are a frequent stumbling block. They may occur on the hands and feet, or on the hands alone, or as ringworm of the feet associated with "id" eruptions of the hands. We make a point of never diagnosing ringworm without demonstrating the fungus. This may require repeated examintaions of blisters and scales. Many errors are due to a diagnosis based on clinical appearance only. If the eruption on the hands is an "id" eruption, clearing up the original focus on the feet usually clears the "id" eruption on the hands.

Often confused with industrial dermatitis are dyshidrosis and toxic eruptions, which usually consist of superficial vesicles and recur in crops. They are more common on the palmar surfaces and rarely itch as much as contact dermatitis.

Recalcitrant eruptions and pustular psoriasis may befuddle the diagnosis. They present crops of small flat intra-epidermal pustules on the palms which tend to dry and scale off. They are frequently associated with similar lesions on the soles and are extremely resistant to treatment.

Closely resembling contact dermatitis is a condition formerly known as orbicular eczema, which we call infectious dermatitis. However the lesions are better defined and itch less.

Discussion

IT IS evident from these statements that to solve the problem of contact dermatitis in industry, especially the type which persists after discontinuing the occupation, it is necessary not only to identify the irritant and understand the working conditions, but also to have an intimate knowledge of the constitutional predisposition and physical condition of the patient, as well as an acquaintance with his home environment (not often easily accomplished, but essential to solving the problem of prolonged disability).

Conclusions

CONTACT dermatitis in industry may be due to
(a) Direct irritants,
(b) Allergens.

2. Some of the factors which promote the production of hypersensitivity have been discussed. They refer to conditions of the patient's environment and personal history.

3. The problem of persistent industrial dermatitis has been stressed.

4. The importance of accurate diagnosis has been emphasized.

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Discussion:

DR. HERBERT RATTNER (Chicago): It is not an exaggeration or over-statement to say that one of the most interesting problems in medicine today is occupational eruptions, especially contact dermatitis. That certain occupations were prone to develop dermatitis has long been known. That is as old as industry itself. But this concept of contact dermatitis is relatively new. It is only in recent years that we have come to recognize that there is a large group of eruptions occurring, in various occupations, in persons with hypersensitive skin only. This type of eruption just can not be over-emphasized.

Dr. Ebert has mentioned some very important facts regarding this type of dermatitis. We were told that potentially all workers are hypersensitive, a fact which may one day have far-reaching significance. We were told, also, that hypersensitiveness may be localized to one area of the skin. It need not be generalized—a fact that has helped to solve many, many really puzzling cases. Dr. Ebert then enumerated the numerous factors which may play a role in the production and persistence of this type of occupational eruptions, both congenital and concurrent. All of them are very important, and the fact that there is such a host of them simply emphasizes the complexity of the whole subject.

As I see it, the problem here is the same as it is in so many branches of medicine: The necessity for an accurate diagnosis. Dr. Ebert has indicated the value of the patch test in the diagnosis for this type of eruption. That I would like to emphasize. I think the development of the patch test is the one important factor for our newer knowledge of contact eruptions.

The technique of the patch test is simple. The factors that govern the interpretations can easily be learned and, incidentally, for those of you who are interested, these factors are enumerated in the exhibit of the Chicago Dermatological Society.

The patch test is simply the procedure wherein we attempt to reproduce dermatitis under supervision, under conditions that are controlled. We attempt, as nearly as possible, to imitate the conditions under which the dermatitis originally developed.

Frequently, in these cases of contact dermatitis, more than one substance is suspected, and with the patch test you can usually run down the offending agent.

The patch test can be used also as a prognostic agent. Heretofore it has been used almost entirely as a diagnostic agent, but it can be used prognostically.

A chemical company recently developed an antiseptic detergent to be used in washing dishes in restaurants. They were anxious to learn what its potential qualities were in contained irritants. This was very important. We undertook the study at Cook County hospital. We patch-tested several hundred cases—men and women of all ages, black and white, and various occupations. Some had normal skins and some had diseased skins. In other words, we took a group as nearly representative as possible of the cross-section of population that would be apt to use this detergent.

We found that a certain percentage of them gave positive skin tests. But, of more importance, we found that the majority of those who yielded positive reactions did so because of an ingredient that was not important and could be easily displaced. So, the patch test in this instance was of real service.

My own experience with patch tests has been more in private practice and with cosmetics, because I have found that industry has been unwilling to undertake them. The tests are painstaking, and often time-consuming. They have to be repeated frequently. Patients have to be seen at frequent intervals, and it takes a long time to reach a conclusion on an adequate study. For these reasons, I suppose, industry has been slow to adopt them. This has proved a hardship when dermatological cases have been sent in, particularly where compensation is involved.

The patch test, as valuable as it is, can not displace diagnostic acumen. However, as an objective diagnostic measure, it has proved its value and it is worth your attention.

This whole subject, as I said at the beginning, is one of the most *interesting* in medicine—without regard to its importance. Dr. Ebert has taken a large and very complicated subject and has given us a practical summary, a workable outline. I think it is to be regretted that his time limitation was such that he was unable to go into some of the factors with greater detail.

CHAIRMAN WM. D. McNALLY: As you see, contact dermatitis is very important, and it is becoming more important with the extended use of solvents. Solvents may be used for a number of years and contact dermatitis may not appear. When the industrial physician sees contact dermatitis where the man has been working with a solvent, he will very likely first believe that this solvent was not the real cause. But it seems that a person can work with a solvent for a number of years and his skin, liver, kidneys and other organs will be able to take care of a certain amount of it. When that amount is exceeded, he gets dermatitis.

DR. J. J. PENDERGAST (Medical Director, Chrysler Corporation): We recognize that dermatitis is a very important subject in industry. We have recognized it so much so that we have a man whose sole job is to run down all cases of dermatology that occur in our plants. He is occupied not only in diagnostic work but also in running down the job, and doing the patch test and the various other tests necessary to differentiate the true cases of occupational dermatitis from the cases that are non-occupational.

The work has been very satisfactorily done. But it is comparatively young as yet, and so I am unable to give you any information regarding statistics on how many cases we have found.

DR. A. W. GRAY (Milwaukee): It may seem rather venturesome for an internist to attempt to discuss an epidermiological subject, but I am not going to do exactly that, because I want to leave one thought with you.

I came across or developed an idea, myself, many years ago, just about the time the term "allergy" was coined—not very long after the Theobald Smith phenomenon was demonstrated — and at a time when we all

seemed to agree that they had nothing in common. The discussion as to whether there is any connection is still going on today. The thought I want to leave with you is that most pathological processes, whether skin or internal, are actually based on normal physiological processes. We should not lose sight of that. May I say in passing that, as an internist, I have never yet found a patient who didn't have a skin. They all come to me with skins on them.

At one time I was very much interested in an infant's hospital and also interested in allergy. For some reason or other I got the idea out of thin air that when babies began to get beyond milk on to different foods—spinach, orange juice, and what not—when they reached the age of five or six months (this was 25 years or so ago), that very shortly after starting that new food, a positive skin test would appear for that new food. Now that was an amazing finding. I talked with Manning Vaughan about it two or three years ago. He said: "That's a fact. There is no question about it. Every human being is physiologically allergic, and the individuals we call allergic individuals are simply those who have gone on with a higher threshold (or perhaps you would call it a lower threshold) of susceptibility."

I think that should be kept in mind in the development of these dermatoses which are on the basis of allergy.

I would like to ask Dr. Ebert, when he determines that the original onslaught due to industry has passed away, whether the individual continues with a low threshold of susceptibility, and how much? The experience in industry has been influenced, perhaps, locally or somewhat generally, because he says not only is the dermatitis local but it may also become general. How soon and under what circumstances does he think that the disability has passed away.

Here is just one other thought I want to leave that is perhaps also quite theoretical. In many of the allergic cases we recognize some influence—just what it is, we do not know—of calcium. We notice that the calcium phosphorus balance in the body has a decided influence. We got some fine tests once upon a time by injecting, according to Potticker, calcium chloride intravenously. Here and there we had a case of asthma controlled wonderfully. Then we arrived at the time when plasma calcium was not a sufficient laboratory investigation for us and we realized that ionized calcium was the thing we were hunting for in the blood plasma. Since that time, many of these things we call allergic manifestations of different kinds do rather miraculously disappear here and there. I think it is a real clinical observation and not just a guess that when we find any of these conditions in which the ionized calcium is not in proportion and our calcium phosphorus balance is not correct, some effect does occur in many of these cases from the proper injection of the calcium.

DR. EBERT: To Dr. Pendergast, I might say that the large corporation is probably more favorably situated to make an accurate and scientific study of the common sources of dermatitis in industry than the smaller corporation. It is sometimes rather expensive, but in the long run I think it pays to look for potential sources of irritation and to identify them, and then, if possible, to eliminate them, which very frequently can be done, from the industry.

I was pleased to hear Dr. Gray's discussion, because it is the ambition of every dermatologist to feel that dermatology is simply one phase of the study of internal medicine, and that the skin is not an organ isolated from all the rest of the body, to be studied objectively, with the rest of the body forgotten. I think I brought that point out in my paper. I tried to emphasize the fact that where we have the persistent industrial dermatitis, it may, in many instances, be due to some of the general medical conditions that I mentioned and that Dr. Gray mentioned.

In answer to his question as to when the disability should cease: With any of the factors present that I mentioned in this paper—for instance, if there was a history of previous dermatitis or contact dermatitis before the patient entered the industry, and, particularly, if there was a history of the various atopic manifestations that I mentioned, and if the patient was of the constitution temperament that I described, I should say that the responsibility of the employer for that patient after a reasonable length of time would cease. In other words, he can not hook himself to the company for life just because he happens to be particularly susceptible.

Air Conditioning

—in Relation to Industrial Hygiene—

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AIR conditioning was brought into being at the beginning of this century, some 30 years ago, because of a need in industrial processes: it was born of industry. It has more recently come into the limelight in the guise of a new industry, owing to its spectacular achievements in promoting human comfort. Its public acceptance has been primarily due to its popularization in theatres and railroad cars, and from this it has been extended to many other fields where public patronage is solicited.

There are at present at least three distinct fields in which it finds application. First the original industrial field where products are primarily concerned; second, the commercial field where it pays its way by increasing patronage, and, third, the personal or luxury field where it finds application in homes and private offices.

Air conditioning was demanded by industry wherever "weather sensitive," that is, hygroscopic, products are manufactured. The lithographing art had muddled along for years in its fight with the weather. Variations in humidity interfered with the register, and great skill was required to do good work under difficult and variable conditions. In 1902 the author was assigned the task of devising equipment to maintain uniform humidity in a lithographing plant. From the research involved in this assignment the present art of air conditioning was largely developed.

This art has subsequently become of great economic importance to those industries whose products are affected by weather conditions—as for example, in all the textile industries, including rayon which could not be manufactured successfully without it; in all parts of the tobacco in-

dustry, such as in the manufacture of cigars and cigarettes; in the printing and lithographing industry; in the manufacturing and processing of paper and paper products; in the manufacture of chocolate and confectionery; in the manufacture of gelatin products, such as capsules and photographic films—in fact in a long list of over 100 different industries.

In these industries air conditioning pays for itself many times over in the improvement of quality and increase in production. In such industries the effect on the employee has either been overlooked or else considered of secondary importance. This is not as it should be, because improvement in product must not be made at the expense of human well being, nor can the employer afford to overlook the real if sometimes intangible economic advantage of efficient and contented labor.

Therefore it is well to examine industrial air conditioning with relation to these factors as well as to its effect on the product.

Principles of Industrial Air Conditioning

IN ORDER that we may intelligently explore the possibilities and limitations of industrial air conditioning, it is well to consider briefly the fundamental principles and processes involved. Air conditioning for industry usually requires an exceedingly exact control of relative humidity, as this is the prime factor effecting hygroscopic materials. In certain products, however, uniform temperatures either at a high or low level, may be desirable or necessary.

Many products such as cotton and tobacco require high humidities for successful processing. This was well recognized in the early attempt of the English manufacturer to add moisture to the air in his cotton spinning and weaving rooms. The only thought was to add moisture, and at first he used steam jets and vapor pots and sprinkled the floor in his endeavor to get moisture in the air. These crude methods only added more heat to an already overheated room. Later he improved this process by overhead atomizing sprays which absorbed some of the heat by evaporation, but the success of such means of humidification depended on minimizing ventilation which was necessary to remove the great amount of heat generated by his machinery. Working conditions became so bad in English mills that a commission was appointed by Parliament to study mill conditions and practices. As a result of the findings of this commission, a drastic law was passed prohibiting artificial humidification when specific room temperatures were exceeded. While no corresponding law for the protection of the workers was ever put in force in this country, conditions here were nearly as bad, but in 1906, both Stewart W. Cramer, of Charlotte, North Carolina, and the author devised systems of air conditioning for textile mills which would control temperature as well as humidity in an economical and practical manner. Mr. Cramer's system involved the use of room atomizing sprays with auxiliary mechanical ventilation. The author's system controlled both the temperature and the humidity by the introduction of cool, saturated air in sufficient quantities to remove the heat generated within the mill, and required *no sprays* or other means of humidification *within* the mill itself. This marked the advent of modern air conditioning.

The Carrier process of air conditioning in mills was based on the discovery of the fundamental principle that for any given relative humidity there was a definite temperature difference between the dewpoint and the room temperature—that is, between the temperature of the saturated air introduced and the temperature of the room. For example, if a relative humidity of 70% is to be maintained, then the difference between dewpoint temperature and the room temperature must be approximately 11½°. In other words, enough saturated air must be introduced into the room or mill to cool that room within 11½° of the temperature of the saturated air. In winter time both the temperature of the saturated air and the room temperature were controlled, but in the summer time all outside air was employed so that the air could be saturated at the lowest temperature practicable without the use of refrigeration.

The second discovery in relation to this process of air conditioning was also to be of great importance to industry and to the art of air conditioning—that is, when air is passed through a spray of recirculated water and brought substantially to the point of saturation, it will always be cooled to the outside wet bulb temperature. The wet bulb temperature is the temperature indicated by a thermometer covered by a wetted wick. This thermometer will read from 10° to 30° lower than the dry bulb thermometer depending upon the dryness of the outside air. The average maximum wet bulb temperature during the hottest months varies from 65° to 70° in different parts of the United States and there are but few days when the maximum wet bulb temperature exceeds 75°. This will give some idea of the temperatures which are available for air conditioning without refrigeration for mills in the United States. For example, the average mill temperature where 70% relative humidity is being maintained by the process described would be from 76° to 81°, not an entirely comfortable temperature but a practicable, healthful, working temperature—a very much more comfortable and healthful condition, by the way, than is found in unconditioned mills without humidification.

The principle of the humidifier used in cooling and saturating the air is that evaporation is a cooling process in which the sensible heat of the air is converted into latent heat of water vapor. The degree of cooling thus obtained obviously depends upon the dryness of the outdoor air entering the humidifier and may be expressed by an exact mathematical formula. The Carrier process is is now in general use in industry in all parts of the world. Where lower temperatures are required in the room, the air is further cooled by refrigeration of the water spray which makes it pos-

sible to control at any desired fixed temperature as well as at any desired relative humidity.

Air Conditioning for Human Comfort

IT SHOULD be noted that the requirements and the equipment for air conditioning in industry are frequently quite different from those required in commercial air conditioning for human comfort. Air conditioning for human comfort does not require an exact relative humidity but while this can be somewhat variable, it should be relatively low, as compared with the conditions in textile mills for example.

The system of evaporative cooling so successfully used for high humidities in industry is generally unsatisfactory in air conditioning for human comfort, the exception being in hot dry climates. In industrial humidification the room temperature is allowed to vary with the outside temperature and large volumes of air are employed to remove heat and to maintain the high humidities. In cooling installations for comfort, relatively small quantities of dehumidified air are employed and the temperature is definitely controllable within the comfort range. In another class of industries, however, even a more exact temperature control is required than in comfort installations. Where cigar and cigarette machines are employed, uniform temperature is necessary for maximum production. In chocolate factories a uniform temperature at 65° is necessary with low relative humidity to give the best product.

Industrial and Hygienic Requirements

CAN the requirements for the processing of materials be reconciled with those of the comfort and efficiency of the operatives? We have already seen that better working conditions have been produced in textile mills than existed before the advent of modern air conditioning. Temperatures in mill practice are considerably lower than the maximum outdoor temperatures, while under average summer weather conditions they do not greatly exceed outdoor temperatures.

Under the management of a large manufacturing establishment in Virginia there were, side by side, an old cotton mill and a new cotton mill that was air conditioned by modern methods. The improvement in the working conditions in the new mill was so great that it was found to be a real inducement to workers. As a result there was always a waiting list of applicants from which the most skilled and efficient workers could be selected. Obviously this condition greatly improved the efficiency of this particular mill apart from the gain due to the better processing of the product.

Prior to the advent of air conditioning, tobacco stemming rooms had never been humidified. Not only was there a loss from the breakage of the leaf in process, but the dust conditions were the most terrible that could be imagined. You could not see half the length of the room. It was like being in a dust storm. A person who was not accustomed to it could hardly go into the room even with a respirator. The operatives worked with handkerchiefs tied over their mouths which they used as home-made respirators. Air conditioning was installed to remove the dust through high humidities and rapid air change. As a result, the room was clear and operatives could work in it without any discomfort or ill effects, moreover, loss by breakage was sufficiently reduced to pay for the installation. Not only was the air in this room freed from dust but it was also comfortably cooled in summer, so much so that workmen from other parts of the factory went into this room to eat their lunch on hot days. This is an excellent example of combining benefits to the product with improved hygienic conditions for the operative.

In industries where high humidities and higher than average temperatures are employed, it is desirable that dressing rooms be provided so that the workers can change to dry, warm clothing before going out of doors. This is the practice in many of the best textile mills. Where this precaution is taken no ill effects are experienced by the workers from the high humidities even during cold winter months. In chocolate factories where the room temperature must necessarily be 65°, the workers provide themselves with additional clothing and owing to the uniformity of the working temperature no ill effects are experienced; in fact the health of the workers seems to be better than where they are working under higher but variable temperatures.

In the installation of the air conditioning plant in the Robinson Deep, a gold mine on the Rand, 8,500 ft. deep, the air entering the shaft at the surface is cooled uniformly throughout the year to a temperature of 35°. This permits the efficient operation of the mine at its greatest depth although the temperature rises to 86°, due to the compression of the air and to the heat from the rocks. The native miners coming from these hot humid depths are brought up through the cold shaft to the surface at the end of the shift, and there were considerable misgivings on the part of the management, when this installation was made, that such a severe change in temperature might increase illness and the incidence of pneumonia already prevalent among the miners. As a partial safeguard against this possibility, a rest room was provided at the 4,000-ft. level and all workers were required to put on warm sheepskin jackets provided by the company before they ascended through the cold air shaft to the surface.

The medical statistics in connection with this operation are most interesting. The same company operates two separate shafts, the Turf shaft where the cooling plant is installed and the Chris shaft which has no cooling plant. Each shaft has its own compound where the native labor force is housed. Their medical report states: "There has been a slight increase in the incidence of pneumonia at the main compound where the Chris labor force is housed but in the Turf compound the incidence dropped from 58.4 per thousand during 1935 to 34.4 per thousand in 1936." This is a decrease of over 40% in the incidence of pneu-

monia as compared with former records. A most interesting result, directly contrary to the expectations.

In industries involving high temperatures such as steel rolling mills, for example, it would be impossible to operate in semi-tropical climates during a considerable portion of the year without the aid of air conditioning. A good example of this is the great Tata Steel Company in India, the largest steel plant in the British empire. The operations in this plant were necessarily shut down during the hot monsoon season, but by the aid of air conditioning they were able to operate continuously. Here large volumes of air are drawn through humidifiers where the air is saturated and cooled to the wet bulb temperature, usually dropping the outside air temperature from 105° to between 70° and 75° purely by evaporative cooling. This air is blown through underground tunnels and discharged through adjustable outlets or nozzles directly on the men who are working at the rollers. The lowered temperature of the air together with the velocity was found to produce ample cooling to permit the men to work at maximum efficiency.

Greater emphasis needs to be placed on the benefits of air conditioning in increasing human efficiency and health in industry. To this end it is desirable that those supervising industrial sanitation should collect and make available more data in this field. This would not merely be a service in the interest of public welfare, but would also lead to more efficient and lower cost of operation on the part of the manufacturer.

How Air Conditioning Improves Efficiency

IN ORDER that the standards of air conditioning may be properly established, it is necessary to study the physiological and sensory reactions in relation to the air conditioning factors of temperature, humidity and air motion.

The determination of these effects on human efficiency depends largely on laboratory research, but this is supplemented by some actual statistics obtained in industry. The American Society of Heating and Ventilating Engineers in conjunction with the Bureau of Mines at Pittsburgh have made some very interesting studies on the effect of temperature, humidity and air motion in relation to human comfort and human efficiency. These researches were begun in 1921. They resulted in the development of what is known as the "comfort chart" which indicates the variations of temperature, humidity and air motion which give equal sensations of warmth. For practical reasons, these researches and the chart excluded the effect of radiation except as it naturally occurs to surroundings of the same temperature as that of the air, since this may be considered a normal condition. The effect of radiation in removing body heat is covered by the publication of December 1. 1928, by Dr. L. B. Aldrich, of the Smithsonian Institute, entitled "A Study of Body Radiation." Further research is needed to correlate unusual or artificial radiation effects with the other three factors affecting human comfort and sensation of warmth.

Some of the principal findings in these investigations are of considerable interest. The first important finding was, as might be expected, that humidity is an equally important element with temperature in affecting the sensation of warmth. Saturated air at 65° feels precisely as warm as air at 72° and 10% relative humidity, normal radiation effect included, while air at 80° saturated feels as hot as air at 100° with 10% relative humidity; a spread in dry bulb temperature in the first case of 7° and in the second case of 20°. These results were obtained with air motion of about 15 ft. per minute. Increased air motion greatly lowers the scale of temperature sensation. The lines of equal sensations of warmth for varying conditions are designated in terms of so-called effective temperature." The effective temperature for the first illustration is 65° and the effective temperature for the second illustration is 80°. Experiments were also made as to the variation in metabolism at different effective temperatures and also as to the relation between the total heat loss from the human body and effective temperature. These experiments showed that the heat loss from the human body between 65° effective temperature and 87° effective temperature was nearly constant when the subject was at rest and that the heat loss in this range was slightly under 400 B.T.U. per minute for the average person weighing 165 lbs. At effective temperatures lower than this range, the heat loss and the metabolism both increased to a marked degree, while above 87° effective temperature the heat loss from the human body dropped off nearly in a straight line while the metabolism or heat produced by the body *increased.* This is obviously the condition leading to a heat stroke where a balance can no longer be obtained between the heat produced and the heat removed. Since the increase in metabolism, increases with muscular work performed, this point of balance occurs at a considerably lower temperature with a person working.

Heat is disposed from the human body in three ways; by evaporation from the skin and lungs, by convection or heat interchange with the surrounding air, and by radiation to surrounding objects. The minimum temperatures for comfort and with the person at rest, and the disposal of heat by the body by these three methods at normal room temperature are about in the following proportions: evaporation 24%, convection 30%, and radiation 46%.

In a room, however, where the air and surrounding walls are at average skin temperature, obviously no heat is removed by either radiation or convection and the entire output of heat from the human body is in the form of latent heat of evaporation. In the human being, of course, this comes primarily from the skin. Between these two points the percentage of heat removed by evaporation is nearly a straight line relationship. This, of course, should be expected because with relatively constant metabolism over a considerable

range of effective temperatures, the equilibrium of body temperature is maintained largely by variation in evaporation.

A rather surprising corollary to this principle is that the rate of evaporation from the body is independent of the dryness of the air, contrary to the usual supposition, and is dependent solely upon the dry bulb or sensible temperature of the air and surrounding objects. It is also a fact that the difference in the heat generated by a person at rest and that generated by one doing muscular work must be dissipated largely by additional evaporation. This also is independent of the dryness of the air. The human body obviously does not follow the law of evaporation from a wetted surface but its evaporation is controlled solely by the heat regulating mechanism, which increases or decreases the amount of moisture available for evaporation in order to maintain a balance between metabolism and heat loss.

While it has been shown that a person at rest can endure conditions as severe as 87° effective temperature, or the equivalent of saturated air at 87°, yet the ability of that person to do work rapidly decreases at effective temperatures above 75°. This is measured by an individual performing the maximum amount of work for which he was capable under different conditions. At 93° effective temperature he could accomplish only one half the work that he could at 75° effective temperature. Interesting data under working conditions have also been presented by Vernon for British coal mines. The relative output for miners at 82° effective temperature was 59% of their output at 66° effective temperature where it was the maximum, while at 75° effective temperature their output was 91% as great as that at 66°. This shows the important part that air conditioning can play in increasing the efficiency of the worker. The improvement of temperature and humidity conditions by air conditioning also plays an important part in reducing industrial accidents. Osborn and Vernon found that the frequency of accidents in the British munition factories reached a maximum at 67½° dry bulb temperature and that they increased rapidly above and below this temperature. This was with average normal relative humidities.

Under more adverse conditions, such as those met at the Moro Velho gold mine in Brazil, 20 fatal accidents occurred in 16 months prior to the installation of a refrigerating and air conditioning system, when the effective temperature in the mine averaged 90½°. During the 16 months after the installation of the equipment, only six accidents occurred, owing to greatly improved working conditions and output improved 13%.

The physiological effect of uncomfortably high temperatures and humidities seems to be principally that of increased fatigue, and this not only lowers the efficiency but also reduces the alertness of the individual in avoiding accidents. Exact industrial data as to health and efficiency of employees are usually difficult to obtain and sometimes more difficult to interpret accurately. The following are some of the facts obtained which indicate the improvement in health and efficiency of employees as a result of air conditioning.

The management of the Los Angeles Times has stated: "We have an employees' organization composed of some 1100 odd of our people engaged in the several departments of The Times Building. It is in fact a mutual insurance group paying sick benefits for time off because of illness. The organization has been in existence between 10 and 11 years, and in checking up the health record, based on the relative number of days off because of illness, it develops that in the first year of occupancy of the air conditioned building there was a decrease of 46% in illness serious enough to cause layoffs—in other words our employees in the building were 46% healthier than they had been during the best of the previous 10 or 11 years since the mutual insurance plan for our employees has been in operation. In any event the annual assessment for the year was 46% less than it had been in any of the preceding 10 years."

On the other hand, officials of the New York Metropolitan Life Insurance Company state that in their installation "air conditioning has not shown any measurable effects on the incidence or duration of absences for upper respiratory infections or of non-respiratory illnesses."

However, Thomson & Company, New York printers, report that "during the period of about 15 months since . . . air conditioning apparatus has been in our plant, we have not had to make a single claim on the Metropolitan Life Insurance Company on account of illness to employee."

The Chicago Title & Trust Company state in relation to their air conditioning installation: "We have found that it has increased efficiency. We have also found that the 'afternoon lag' has been greatly eliminated; in fact, our employees in the summer months prefer to remain in rather than go outdoors for their noon-day lunch. No one seems to be logy or sleepy in the late afternoons. Apparently they are just as refreshed at four in the afternoon as at nine in the morning."

An office building in Nebraska reports as follows: "Loss from absence expressed in hours: 1933 without air conditioning—3,537 hours; 1935 with air conditioning—2,066 hours. The improvement was 41%. In July 1935 the improvement reached the highest point, being nearly 50%."

The results of a questionnaire sent to tenants in the completely air conditioned office building of the Philadelphia Saving Fund Society were as follows: "92% stated that air conditioning was beneficial to their health—95% felt that their efficiency had been enhanced—90% reported less fatigue in summer (72% in winter)—82% reported fewer winter colds—65% said that their colds were less severe—65% of those afflicted with hay fever said they had been benefited." The latter, of course, are merely individual reactions having qualitative but not a quantitative value.

Acclimatization

THE acclimatization of people to different conditions is quite interesting. In England, for example, where the climate is relatively cool in

summer and little heat is employed in the home, temperatures of 65° to 70° in factories which are common with us would be altogether too warm for the British workers and temperatures of from 80° to 85° with high humidities, which our workers stand without noticeable ill effects in summer, would be considered insufferable in England. On the other hand, workers in tropical and semi-tropical countries such as India, for example, require temperatures above 80°. An illustration of this was found in the first air conditioning plant installed in an Indian cotton mill. It was started up during the monsoon season when the outside temperature was 105° and the air was very dry. The mill temperatures to which the Indian workers were accustomed ran as high as 110° and 115°. The engineer in charge was greatly delighted when on a 105° day outside he maintained a temperature of 80° with 80% relative humidity inside the mill, but the Indian operatives refused to work in so cold an atmosphere and he was obliged to provide a means for heating his spray water.

H. C. Bazett says in his article on physiological responses to heat in *Physiological Reviews*: "The acclimatization of natives to their own climatic conditions is well recognized. This may be noted even among the varying climates of one country; thus the high room temperatures common in American houses, and often criticized, merely reproduce the ordinary 'comfortable' summer temperature of the locality and are in consequence higher in the southern than in the more northern states. The tendency seems to be to maintain conditions as uniform as possible."

Studies are now being made on the optimum temperatures in a conditioned building with reference both to comfort and to shock, either in entering or leaving the conditioned space. It is common knowledge that many of our conditioned spaces are kept altogether too cold for either comfort or health. This is not the fault of air conditioning, because the temperature can be controlled at any desired level. The users and operators of air conditioning equipment need education. The undesirable low temperatures frequently found are often the result of the owners' desire to "show off." This undesirable state of affairs will gradually disappear as air conditioning comes into more general use.

When the Senate Room at the U. S. Capitol was first conditioned in 1927, the architect thought that about 75° in summer would be a suitable temperature, but it was soon found that the temperature had to be varied with the outside conditions, partly to allow for change in dress in the hotter weather and partly on account of the slowness of acclimatization between two severe different temperatures; 80° with 40% relative humidity was found too low and the temperature had to be raised to 82° when the temperature outside was 95° or higher. At this point it was found that no Senator complained of its being too cool. Some would have liked it cooler but were reasonably satisfied.

Professor C. P. Yaglou, of the Harvard School of Public Health, has made some very interesting investigations of optimum temperatures both winter and summer, and found a great variation between individuals. He found the summer zone of comfort for different individuals to extend between a range of 64° effective temperature to 79° effective temperature and the point at which 98% of the subjects were comfortable was at 71° effective temperature. This checks fairly well with the results in the U. S. Senate. There the optimum effective temperature for all subjects in extremely hot weather was 74°, that is 82° with approximately 40% relative humidity. In general, it is better that the temperature be maintained somewhat above the optimum rather than below. Less harm is done by some people being too warm than by allowing other people to suffer from being too cold.

Dr. C. A. Mills, of the Cincinnati General Hospital, speaking of Oriental conditions with which he is personally familiar, says: "The Oriental summers, being hot and humid, cause the heat production in the body to be suppressed to a minimum on account of the difficulty of heat loss, and this affects particularly the adrenal glands, lowering their function."

Professor Philip Drinker, of the Department of Industrial Hygiene, Harvard School of Public Health, says in an article in the *Journal of Industrial Hygiene and Toxicology*, December, 1936: "One of the most interesting factors in air conditioning is the effect of acclimatization. It is recognized but is not a factor which as yet can be measured physiologically." He quotes the following scale of temperatures from the American Society of Heating & Ventilating Engineers:

Outdoor Temperature	Indoor Air Conditions with Dewpoint Constant at 57° F.			
Dry Bulb °F	Dry Bulb °F	Wet Bulb °F	R.H. Per cent	Effective Temperature
95	80.0	65.0	45	73
90	78.0	64.5		72
85	76.5	64.0	50	71
80	75.0	63.5		70
75	73.5	63.0		69
70	72.0	62.5	60	68

He also states: "It is recognized that still higher temperatures in summer are needed for exposures shorter than one hour, as for instance, in banks, restaurants, department stores, etc." Studies are now being made on the relation of such temperature schedules to the time of exposure. Generally it is being found that higher temperatures with lower relative humidities than usually employed are desirable.

The air conditioning engineer welcomes any assistance the medical profession can give on this important subject of optimum summer temperatures with relation to outside conditions of temperature and humidity. The engineer can produce any condition within reason desired. He can determine statistically what conditions produce optimum comfort to the occupants of a building under varying conditions, but he does

not pretend to be competent to measure the beneficial or unfavorable effects of such temperatures. For this he must rely on the medical profession. It is quite probable that if engineers and physicians could come to some sound demonstrated basis of agreement, measures could be taken to protect the public against improper use of air conditioning equipment. This should have the effect not only of safeguarding the public but also increasing the general acceptance and the extension of the benefits of air conditioning to people generally.

Women in Industry

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IN DEFINING industrial hygiene, Dr. R. R. Sayers states that in its broad aspects it is designed not only to prevent industrial accidents and diseases, but also deals with the general health of workers and includes such subjects as poisons, dusts, abnormal temperatures and humidities, illumination, noise, overcrowding, hours of labor, fatigue, and *women in industry*—as well as several other subjects.

If such is the case, then women in industry represent a true and definite entity. This should call forth a new avenue of research, and that is a study of the "physical breakdown" of the worker by sex—an avenue in which surprisingly little has been done in this country.

I feel that this phase of industrial hygiene should engage the interest of the medical fraternity, because the advent of the female worker into our factory sytem brought with it new issues of physique, of physiological function, of nutrition, of staying power, and of maternity.

In presenting this subject, one may select a single phase of the problem or call attention to some of the general principles involved. For my paper, I have chosen the latter.

Extent of the Problem

WOMEN have always worked. They have always contributed their share to the economic maintenance of themselves and their families when the need arose. Many of them have undertaken a double role—home-maker and producer. At first, their influx into the trades was slow, but it has been accelerated by the mechanization of industry with its division of labor, depressions, wage differential between male and female workers and the World War. Where once the women toiled at home preparing tallow for candles and curing meats, we now find her making incandescent lamps in a factory and as an employee in the meat packing industry. To fully appreciate her influx into the mechanical operations we have only to observe her leaving our large plants dressed in overalls and gauntlets—apparel which is necessitated by her work on a punch press or a drill press, or in welding, spraying, or soldering, as well as in the handling of other machines previously operated by men exclusively.

The recent business slump may illustrate the economic factor in bringing women into the factory. In Illinois, for the month of February, 1938, the male employment decreased 1.9%, but female employment increased 2%. In the manufacturing group, hours worked decreased 1.3% for males but increased 5% for females. During the World War, women were forced into the manufacturing and mechanical industries because of the lack of man power. Industrialists found women cheaper to employ, and their trend into mechanical and manufacturing operations has maintained itself unabated.

I have a few illustrations based upon U. S. Census figures, the National Safety Council benzol study, and our own study of 3,400 plants in Illinois. As to the latter we are in the final stages of tabulation. These illustrations show several facts to which we must direct our attention. They are:

a. That there are almost 11 million females employed in our country, with approximately two million in the manufacturing and mechanical group.

b. That there is a decided change within the manufacturing and mechanical group, so that females are leaving the finer handicraft skilled occupations and going into the semi-skilled and unskilled groups which are more hazardous and laborious.

c. That no great effort is being made to restrict women from hazardous occupations, as their exposures are similar to those experienced by males.

Fig. 1 shows the increase in gainfully occupied females from 1870 to 1930. The footnote is of interest as it reveals an 8.9% gain in female employment and only a 1.4% gain in male employment.

Fig. 2 shows the distribution of our employed women from 1910 to 1930. It is interesting to note the large increases in the professional service, and domestic and personal service and clerical groups. However, these increases have little affected the manufacturing and mechanical group. While this group appears fairly static in regard to the group as a whole, the next illustration reveals an important condition.

Fig. 3 discloses that a great change has taken place within our manufacturing and mechanical group for women. They have been leaving the light and comparatively non-hazardous jobs and going into the much more hazardous and less sanitary work of machine operatives and laborers.

Fig. 4 shows the distribution of females and

their exposures in 2,846 of the 3,400 plants we are now studying in Illinois. It is interesting to note that the female employment constituted 22.4% of the total, and that the chemical, iron and steel, food, metal, and lumber industries had the greater number of female exposures as shown in the last column. Fig. 5 will show what the material exposures are for the 435 plants in the miscellaneous manufacturing industries.

The data in Figs. 4, 5, 6, and 7 were obtained by visual surveys and do not measure the degree or magnitude of the exposure. They merely indicate what potentialities exist and the sources of industrial exposures for females. They also bring out an important fact, which is that 21.8% of the women have lead exposures, 10.9% are exposed to alcohols, esters and ethers, and 13.4% are exposed to organic dusts—which makes 46% of the exposures due to three material groups.

Fig. 6 shows the occupations of females and their exposures in the electrical manufacturing industry, excluding storage battery and lamp manufacturers. The footnote reveals the fact that 49% of the exposures are due to lead—despite our knowledge of the more serious results of lead poisoning in females than among males.

Fig. 7 reveals the exposures and occupations of females in the tinware industry of Illinois.

Fig. 8, from the National Safety Council benzol study, shows to what extent potentialities are actualities—approximately 33% in women exposed.

Fig. 9 reveals the findings of that benzol study. I am wondering if these findings would not be applicable to most of the organic solvents for female exposures.

As to Fig. 10, having shown you the extent of female employment and exposures, let us look at the end result. Perhaps it can be explained on the basis of physiology and biology, that she is different

FIG. 1

FEMALES GAINFULLY OCCUPIED IN U. S.
1870 — 1930
(U. S. Census Figures)

Year	Female Population	Population 10 years old and over	Females 10 years old and over Gainfully Occupied: Number	% total population	% populat'n 10 years and over
1870	18,064,806	13,970,078	1,836,288	9.6	13.1
1880	24,636,963	18,025,627	2,647,157	10.7	14.7
1890	30,554,370	23,060,900	4,005,532	13.1	17.4
1900	37,178,127	28,246,384	5,319,397	14.3	18.8
1910	44,638,989	34,552,712	8,075,772	18.1	23.4
1920	51,810,189	40,449,346	8,549,511	16.5	21.1
1930	60,637,966	48,773,249	10,752,116	17.7	22.0

% gain in gainfully occupied females, 10 years and over (1870-1930) = 8.3
% gain in gainfully occupied males, 10 years and over (1870-1930) = 1.4

FIG. 2

DISTRIBUTION OF GAINFULLY OCCUPIED POPULATION
(U. S, Census Figures)

INDUSTRY	1910		1920		1930	
	Male	Female	Male	Female	Male	Female
All Occupations	30,091,564	8,075,772	33,064,737	8,549,511	38,077,804	10,752,116
Agriculture	10,581,685	1,806,624	9,582,666	1,083,146	9,562,059	909,939
Forestry and Fishing	241,249	557	269,541	673	250,140	329
Extraction of Minerals	964,075	1,094	1,087,359	2,864	983,564	759
Manufacturing and Mechanical	8,835,698	1,820,847	10,901,527	1,930,332	12,224,345	1,886,307
Transportation and Communication	2,549,922	115,347	2,872,559	224,270	3,561,943	281,204
Trade	3,160,562	472,703	3,585,701	671,983	5,118,787	962,680
Public Service	426,606	4,836	727,939	10,506	838,622	17,583
Professional Service	976,523	734,752	1,154,221	1,017,030	1,727,650	1,526,234
Domestic and Personal Service	1,225,395	2,530,403	1,193,313	2,186,682	1,772,200	3,180,251
Clerical Occupations	1,129,848	588,609	1,689,911	1,421,825	2,038,494	1,886,830

FIG. 3

TRENDS IN FEMALE OCCUPATIONS
1910 — 1930

OCCUPATIONS	% Change in Number of Employed Females: +	—
Dressmakers, etc., (not in factory)		64.7
Milliners, millinery dealers		67.2
Tailoresses		46.6
Factory operatives	39.7	
Factory laborers	56.6	

FIG. 4

TABLE SHOWING DISTRIBUTION OF FEMALES AND THEIR EXPOSURES IN ILLINOIS INDUSTRIES

TYPE OF INDUSTRY	No. of Plants	Total Plant Pop. (Not inc. off.)	Total Female Plant pop. (n. i. c.)	Female Pop. in % of Total	Total No. Female Exposures	No. of Exp. per 100 Females
Mining and Quarrying	31	3623	0	0	0	0
Chemical and Allied Industries	254	13268	2637	19.9	2219	84
Cigars and Tobacco	5	500	181	36.2	67	37
Clay, Glass and Stone	66	4391	750	17.1	508	68
Roofing, Asbestos products, Abrasives, etc.	57	4034	243	6.0	146	60
Clothing Industries	79	8393	5919	70.6	2494	42
Food	236	21454	7637	35.6	6400	84
Iron & Steel, Machinery & Vehicle	609	60511	3660	6.1	3102	85
Metal Industries, except Iron and Steel	367	26841	4528	16.9	2530	56
Leather	54	5385	1445	26.8	564	39
Lumber and Furniture	184	12450	1378	11.1	1061	77
Paper Printing and Allied Industries	252	14277	3704	26.0	747	20
Textile Industries	67	5499	3087	56.2	2022	65
Miscellaneous Manufacturing Industries	435	35205	11270	32.0	7347	65
Transportation and Communication	10	567	1	0.2	0	0
Trade (wholesale and retail, except auto.)	1	27	0	0.0	0	0
Personal Service (Laundry, Cleaning, etc.)	97	5739	3577	62.4	476	13
Commercial Service, (Warehouse, Jobbing, etc.)	42	568	47	8.3	58	123
TOTAL	2846	222732	50064	22.4%	29741	59

FIG. 5

NUMBER OF WOMEN EXPOSED, CLASSIFIED BY MATERIAL IN THE MISCELLANEOUS INDUSTRIES LISTED

Brooms and Brushes
Button Factories
Electric Light Power
Electrical Equipment
Batteries
Lamps
Dry Cell Batteries

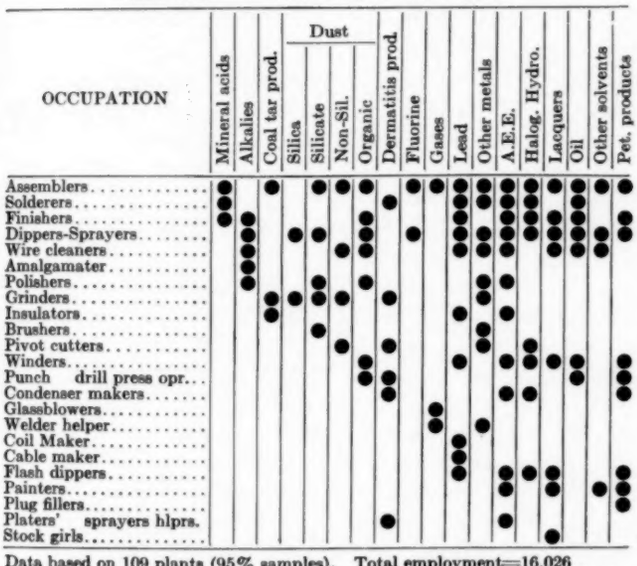
Rubber
Artificial Flowers
Mattresses and Bedding
Signs
Novelties
Hair Goods
Mirrors

Lamp Shades
Other Misc. Mfg.
Scientific Instruments
Plastic Molding
Impregnated Paper
Wood Preservation

							DUSTS					GASES			METALS												
	ACO	ACC	ALK	AMS	CTP	ASB	CDA	ATE	ORG	DYE	FL	H_2S	GAS	AS	CD	MN	RA	SE	NOX	AEE	INK	MED	OS	PNT	SLT
	ACM	ALD	ANI	CHM	CN	CDB	SIL	NOS		DER	CO	SO_2	CL	CR	HG	PB	SB	OM	INF	HLH	LAC	OIL	PET	P	S
TOTAL	7	.....	101	.....	118	.....	.....	323	987	19	51	.....	96	46	16	36	.....	.....	2	806	44	.....	705	79	30
TOTAL	110	22	.....	4	3	.....	33	377	.....	130	14	3	.....	13	14	1603	1	226	123	138	597	124	336	16	.....
% of t'l	0.1	.....	1.4	.....	1.6	.....	.....	4.4	13.4	0.3	0.7	.....	1.3	0.6	0.2	0.5	.....	.....	.....	10.9	0.6	.....	9.6	1.1	0.4
% of t'l	1.5	0.2	.....	0.1	.....	.....	0.4	5.1	.....	1.8	0.2	.....	.....	0.2	0.2	21.8	.....	3.1	1.6	1.9	8.1	1.7	4.6	0.2	.....

FIG. 6

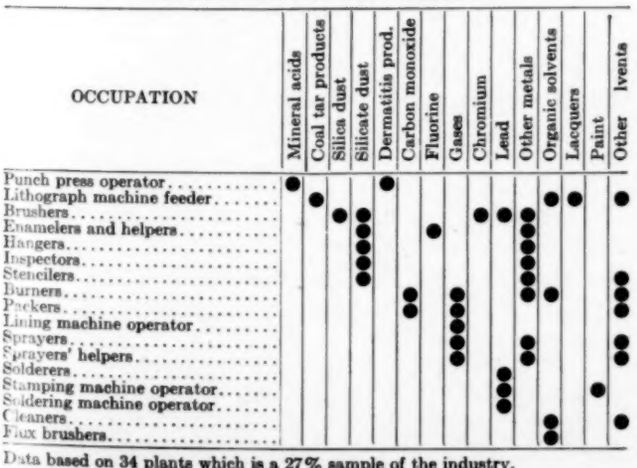
FEMALE OCCUPATIONS AND EXPOSURES IN THE ILLINOIS ELECTRICAL MFG. INDUSTRY



Data based on 109 plants (95% samples). Total employment=16,026
Females=4,798=29%
Total exposures=3,200
Lead=49%
AEE= 9%
Lacquer= 8%

FIG. 7

FEMALE OCCUPATIONS AND EXPOSURES IN THE TINWARE INDUSTRY IN ILLINOIS



Data based on 34 plants which is a 27% sample of the industry.
Female employment was 28% of total employment.

from males when employed in the highly repetitive mechanical operations and in environments of dust, fumes and gases with inadequate control measures.

I HOPE these illustrations disclose in part the extent of our female industrial health problem. I feel certain that it is not a desire for "personal liberty" that takes these women into wage-earning pursuits. Necessity brings them into the factory. Some come to the shops suffering from lack of nourishment, mentally less alert to danger and physically more susceptible to the many harmful substances in use.

By some the employment of women in industry has been looked upon and called a most unwholesome trend. Before the gynecological section of the Southern Medical Association, Dr. Elbert Dunlap said that the added strain placed upon women in industrial life had taken a severe toll of feminine health. He warned that women are not biologically adapted for the serious burdens of gainful occupations.

A century has now passed of experience and progress in our industrial evolution, and it would appear that we should have reached such a high degree of excellence and attained such a standard of hygienic perfection that little more would require to be done. Although something has been achieved, much more remains to be accomplished.

Therefore, if women are economically valuable to industry, we must see to it that they are not merely looked upon as working units in the factory, but, instead, consider them as a woman, on a biological basis, the mother of the race. Although

FIG. 8

RELATION BETWEEN CAUSE AND EFFECT

FACTORY	Number of women exposed to benzol fumes	Number showing positive evidence of benzoil poisoning
Total	79	25
I. Tire and rubber	10	2
II. Photographic supplies	41	16
III. Sanitary tin cans	6	1
IV. Sanitary tin cans	4	1
V. Sanitary tin cans	15	4
VI. Shoes	3	1

her work may be light, it must be remembered that the exposures are still as great and as frequent, the duties highly repetitious, with factors of monotony, fatigue and others—all of which are definite industrial health problems.

The Married Woman in Industry

THE married woman in industry is often the subject of comment. The types of employment these women enter have almost no opportunity for a career. In 1890, only 13.9% of all women workers were married, but by 1930 the proportion had risen to 28.9%, although marriages had increased only slightly in the general population. According to the 1930 census, there were in that year over 3,000,000 married women workers. Of all women gainfully employed in the United States, the majority are single, yet the census of 1930 shows that about 29% were married and 17% widowed or divorced.

FIG. 9

FINDINGS OF BENZOL STUDY

Important findings of the study were the following:

1. Benzol as used in the industries investigated produced chronic poisoning in about 1 out of 3 women.
2. The risk of poisoning was not limited to those who worked directly with benzol. Employees exposed by working in rooms where benzol was used were subject to its effects also.
3. Susceptibility was not shown to be greater in young persons.
4. Benzol poisoning tended to develop during the first year of exposure.
5. In about 10 percent of the positive cases menstrual irregularities occurred. The white-blood-cell count showed a decided decrease in every case.

Because of the tendency to hemorrhage and the deficiency in white blood cells it was especially recommended that pregnant women should not be exposed to benzol fumes.

Almost two-thirds of the gainfully employed married women were found in the manufacturing and mechanical industries, and in personal and domestic service.

The married woman in industry in many instances views the prospect of an addition to her family with anything but favor, and abortifacients or other means of contraception are resorted to. Those who have children are unable to give them proper maternal care. It separates the infant from the mother and thereby increases infant sickness and infant mortality. This also presents a social problem to one which is already medical.

Fig. 10

WOMEN IN INDUSTRY REQUIRE SPECIAL PROTECTION

CAUSES OF DISABILITY	Annual Cases per 1,000		% of Men's Rate
	Women	Men	
Sickness	134.3	77.3	174
Bronchitis	7.3	3.6	203
Influenza	28.0	15.8	177
Tuberculosis	1.4	1.0	140
Infectious diseases	3.8	2.4	158
Nervous diseases	6.9	1.1	627
Skin diseases	3.4	3.0	113

As to the effect of factory work on motherhood, a German study covering 3,000 women and 7,700 children, revealed that the women who worked during the last few weeks of pregnancy gave birth to children of lighter weight than those who stayed at home during the entire pregnancy. The still-birth percentage was greater among the factory workers. The infant mortality was higher among the children of factory workers than among the children in the housewife group.

Therefore, the problem of women in industry also breaks itself down into the handicaps of the married women as well as the single individual.

Susceptibility of Females

AS PHYSICIANS, we know that the burden of sickness varies with sex and age.

It can vary as well with industry. What the many new and unfamiliar industrial substances which come to us each year hold with regard to health does present an unpleasant problem and no doubt a serious one.

Lost time from illness and non-industrial accidents, as reported by the United States Public Health Service, was estimated for males to be about eight days per year on an average; while among females, the loss is about 14 days per year.

In some industries the figure may be lower, and in others it may be higher, than those presented here.

Aspects covering women in the poisonous trades, with their many exposures, are of paramount importance. The literature reveals evidence of a greater susceptibility to poisons on the part of women as compared to men. In England, some 30 years ago, when both men and women worked in white lead factories, the men had a rate of one case of lead poisoning for every 17 employed, while the women had one case for every nine employed. A later study among women pottery workers who worked with the men in the dipping rooms showed a lead rate of almost 5% for the female group, while no cases were reported among the men. An additional study among the dipper helpers showed a lead poisoning rate of 8.4% for the men, while the female rate was 14.4%.

It has also been shown that women workers are likewise more liable to develop the severer forms of lead poisoning, e.g., the brain form. The British figures showed that 34.9% of lead-poisoned women potters suffered from the encephalopathy form of the disease, while only 15% of such cases were among the men. Among the American cases reported, the percentage was 22.5 for females and 5.8 for males.

Concerning the damage to the female generative organs, our information has been chiefly drawn from the lead trades. Striking statistics from both the British and French leave no doubt whatever that a woman who has chronic lead poisoning is more likely to be sterile. If she becomes pregnant, she is more likely to abort or to bear a still-born child.

We have no extensive figures with regard to the other numerous poisons, but we do know that benzol, by causing an anemia, renders a healthy pregnancy almost impossible. Uterine hemorrhages also are common.

During the War the English found that TNT poisoning was worse among women munition workers than among the men; the Germans found that dinitrobenzene was decidedly worse among women workers; and the Americans found that

women in the smokeless powder works suffered more from ether poisoning than did the men.

No doubt there have been others, and there will continue to be many industrial exposures which show their greatest ill effect upon the female sex. This must be true as long as women who are employed continue to enter the manufacturing and mechanical industries.

Preventive Program

THUS FAR I have shown you that industrial hygiene when considered from the standpoint of sex is an important aspect of any industrial health problem. You are now probably thinking in terms of "what should be done," or, in other words, of a preventive program. However, before discussing this point I want to make one thing clear.

Any program undertaken for preventing industrial illnesses and promoting good industrial health necessitates a knowledge of the problems to be solved. Too often the lack of this vital information has retarded progress.

By a knowledge of the problem to be solved, I mean we must know the details of the plant departments, the occupations in each and the number of workers exposed, the types of exposures present, and the health control measures afforded the workers by sex, together with morbidity experience. We, at the Division of Industrial Hygiene in the Illinois Department of Public Health, are in the final period of obtaining just this information for 3,400 plants in this State, so that we may have a better knowledge of our problem. Our survey forms and procedure can readily be applied for the segregation of the male and female industrial health problems.

Form 1 is used by the industrial hygiene engineer to gather basic data concerning each occupation for both males and females in every workroom and department in a plant. The knowledge of the problems depends chiefly upon the accuracy and completeness with which this form is used. Once this information is obtained, the engineer edits the data by placing the exposures of each occupation in the last column. The exposures are signified by a code which can be altered to fit the materials encountered in your plant.

Form 1a is an example of the edited data.

Form 2 is used as a summary tabulation sheet for the number of workers exposed to various hazardous materials in each department. The segregation of females is accomplished by using separate sheets for males and females.

Form 3 is used to tabulate the number of workers exposed in each departmen to certain hazardous materials. Again the segregation of females is accomplished through the use of separate sheets for males and females. By using different sheets for each hazardous material, we have detailed data in regard to who, where, and how many are exposed to lead, benzol or other materials.

Form 4 is used to obtain information concerning health control measures in each department and occupation. This form, used in conjunction with the others, will supply the basic information needed to study industrial health problems.

The analysis derived from this procedure, therefore, will place before the medical director or plant physician the complete potentialities of hazards to female employees as well as for males. He can then follow this up by exact medical and engineering work and ascertain further the actualities of his problem. With this information one can be better fortified to attack the general health problem among females.

I do not intend going into a general industrial hygiene program for the elimination and control of dust, fumes, vapors, gases, etc., as that applies equally to both females and males; but chiefly to enumerate briefly those measures that may be instituted for promoting the health of our industrial female population.

They are as follows:

FORM 1.

INDUSTRIAL HYGIENE SURVEY

Work Room Data Page..... of.....

Name of Plant.....

Products Manufactured, or Service:.....Department..... Work Room.....

Informant's Name.....Surveyed by.....Date.....

Occupation	Number of Persons			Nature of Job	Raw Materials and By-Products	Control Measures							Remarks
	M	F	T										
Total													

FORM 1a.

INDUSTRIAL HYGIENE SURVEY

Work Room Data

Page: 1 of 56

Name of Plant: APEX PACKING CO. Location: CHICAGO

Department: Sausage Processes: Mixing and Stuffing Work Room: 1

Informants Name: J. Call Surveyed by: C. S. Date: 5-4-38

Occupation	Number of Persons M	F	T	Nature of Job	Raw Materials and By-Products	Control Measures: Local Exh.	Isolation	Wet method	Gas Mask	Respirator	Press Hel.	Other	Remarks
Mixer	5	1	6	Mixes meats by machine, adds spices	Meats, spices (pepper, salt, sage) Organic dusts Inorganic salts							+ Safety shoes rubber aprons	S'lt Org Der
Stuffers	8	0	8	Puts meat in machine, stuffs meat in casing by air	Meats mixed with spices							+ Aprons	Der
Linkers	0	25	25	Twists sausage links	Meat in casings							+ Aprons	Der
Tiers	0	8	8	Ties strings at end of sausage links	Meat in casings and cord							+ Aprons	Der
Cookers and Smokers	7	0	7	Cook sausage in steam. Smoke	Steam, wood sawdust Meat. Organic dust. Carbon monoxide							+ Gloves	Org CO Der
Weigher	1	0	1	Weighs sausage to pack	Meat in casings							+	Der
TOTAL	21	34	55										

1. Maintaining complete pre-employment physical examinations of all female workers, to be followed up by frequent periodic checkups. This permits proper placement of the worker.

2. Instituting a system of accurate sickness records for all illnesses and a semi-annual analysis of such records.

3. Prohibiting females in employments involving exposure to lead and benzol.

4. Providing for proper seating, with back rests, for all female employees.

5. Prohibiting women from working three months prior to and after child birth. If pregnant women are employed requiring heavy exertion, an adjustment of work should be instituted until such time as they are capable of returning to heavy

6. Prohibiting night work for women.

7. Affording adequate and clean lunch rooms, and toilet and washing facilities.

8. Establishing and maintaining clean wholesome rest rooms.

9. Emphasizing female health through an educational program.

10. Urging that adequate nursing and medical care be always available.

11. Recommending short rest periods during the morning and afternoon hours.

IN CONCLUSION, I hope I have indicated to you that we are dealing with an important subject in the broad field of industrial hygiene. The female worker, because of her physical structure and performance of maternal functions, is biologically at a disadvantage in the struggle for existence. In

FORM 1.

NUMBER OF PERSONS EXPOSED, CLASSIFIED BY MATERIAL

Name of Plant:..... Page:.....

Dept.	No. of Wr'kers	Dusts: Ac.o	Acc.	ALK	Ams	CTP	Asb	CDa	'ate	Org	Dye	Gases: FI	H_2S	Gas	Metals: As	Cd	Mn	Ra	Se	Nox	AEE	Teh	Med	O.S.	Pnt	S'lt
		Ac.M	Ald	Ani	Chm	CN	CDb	Sil	NoS	MD	Der	CO	SO_2	Cl	Cr	Hg	Pb	Sb	O.M	Inf.	HIH	Lac	Oil	Pet	P	S

FORM 3.

MATERIAL EXPOSURE, BY OCCUPATION

Material Exposure:..... Page:.....

Department	Number of persons exposed, classified by departments.																					Total all Dep'ts.
Population																						
Occupation																						
TOTAL																						
																						%

Population brought forward

competing with male workers amid the many abnormal exposures and hazards of modern industry, she should be the object of the special interest of the industrial physician.

Discussion:

DR. ROY J. DE MOTTE (Pullman Company): When I was asked to open the discussion of Dr. Kronenberg's paper, I told him that I was not well qualified to do this because I had had very little experience with women in industry. However, it is possible that that should not be much of a handicap because sometimes it is easier to talk about a subject if you do not know much about it.

The problem of women in industry, of course, is primarily a problem raised by the economic conditions of the country. We who have supervision over the health of workers in factories, if we could control economic conditions, would say it would be better to have no women in industry. That, of course, would solve the problem.

But that can't be done. We have the problem, and I think Dr. Kronenberg has given us a very clear picture of it—outlining its magnitude and giving us details as to methods of studying it.

We in industrial work, then, should follow the advice given us today. We should study sickness rates. We should study the toxic exposures, particularly in women, because, as he has pointed out, there are certain toxic exposures that are peculiarly detrimental to the female physique.

In the industry with which I am connected, we have very few women. We do have women in upholstering work, and in sewing rooms. Their number is small. But it has been my experience that the sickness rates even in this type of occupation, where there is very little toxic exposure, is higher than it is among an equal number of men workers in other occupations.

One of the principal types of sickness we get in women in industry—perhaps in the homes, also, but particularly in industry—is the nervous diseases. There is a very definite reason for that. A woman works in a factory, say,

FORM 4.

CONTROL MEASURES

Name of Plant..... Page.....

Number of persons to whom indicated control is available

Dept.	Occupation	No. of Workers	Type of Control									
			General Ventilation			Local Exhaust	Isolation	Wet Methods	Gas Masks	Respira-tors	Pressure Helmet	Other
			Positive	Negative	Natural							
	TOTAL											

eight hours a day, whether she is exposed to any particular toxic material or not. Then she goes home, and she is a home-maker, also. She has her home work to do. Many women who have come to me, sick from the factory, have told me they work eight hours there and then until midnight at home.

This, of course, is a very unfortunate situation and we all hope that it will not be necessary for long. We all hope that the economic condition as it exists today which compels these women to work in the factories will not continue. I don't think many of them would choose to work in the factories. I think practically all of them would be very glad if they could get along economically by staying in their homes.

Northwestern University Medical School Department of Industrial Medicine

FRED FITZ, M.D.
Chicago

WITH 50,000,000 industrial workers in America and with men, materials, methods, and machines constantly changing, with new medical advancements, and the continuous eternal checking on industrial disease prevention, it is very apparent that industrial medicine should come to occupy a prominent part in our medical thought. In recognition of this increasing prominence, Northwestern University Medical School, in conjunction with the executive and medical departments of a group of industries, established about two years ago a Department of Occupational Disease within the University. In the formation of this department it was visualized that a medical school with its faculty, library and the facilities offered by its laboratories and dispensaries, could with the cooperation of industry make an intensive and practical investigation of certain aspects of industrial disease. I wish to emphasize at this point that this departure in medical school regime was a joint participation designed to make a practical investigation of occupational disease. There are occupational disease departments in other Universities but to our knowledge very few such departments were born with the concept that practicability must be the corner stone.

The participating industries pledged cooperation in making such a plan tenable.

When the general principles and policies of this department were formulated, certain definite objectives were adhered to:

1. The unit must be a fact finding body without prejudice to any group — industry, labor or the medical profession.
2. The research studies must be as accurate, scientific, and thorough as human facilities would permit.
3. The clinical studies must be of such a standard as to not only meet but to exceed the requirements as established by such groups as the American College of Surgeons.
4. The department must serve as a liaison unit between the medical school and the medical departments of the cooperating industries.

In the organization of the department it was placed within the Medical Department of the University.

This was done to facilitate the activities of the unit in order that productive work could quickly be gotten under way. A director of research has been selected and fellowships established. An executive committee representing the University and the interested industries counsels with the director of the department in matters regarding policy, activities, etc. At the present time there are three Fellows working on various aspects of industrial health problems. Secretarial and technical help was added as required.

In the initial prospectus there appeared a list of four activities. That list has grown and has been subdivided so that at this time there are more than 20 major endeavors. Only a few of these can be discussed today:

CASE STUDIES — It was felt when an employee presents himself with a possible occupational disease that it was not only necessary to determine if he is suffering from the alleged disease but to also ascertain the complete extent of his disability.

A routine case at hand — S.G. — a gray iron chipper for 18 years had some x-ray evidence of pneumoconiosis and presented pulmonary complaints. An extensive hospital study revealed many contributory factors in the man's disability.

The following clinical diagnosis was established:

1. Pneumoconiosis.
2. Congestive heart failure.
3. Prostatism with urinary retention.
4. Laryngeal papilloma (possibly malignant) partially obstructing the larynx.
5. Marked spondylitis deformans.
6. Chronic respiratory tract infection.
7. Extensive focal infection.

This diagnostic summary will serve to illustrate the complexity of many of these problems. It seems evident that it is only by a careful survey of all the available facts that the exact importance of this patient's work as a causal factor in disability could be determined. The medical consultants on this case were in agreement that the non-occupational pathology could well explain all of this person's disability.

It is our impression that such investigations will, as case studies accumulate and postmortem material becomes available, liberate scientific fact from some of the dogmas associated with occupational disease and its attendant work disability. To date more than 30 such cases have been studied

with hospital facilities and approximately 80 cases in the medical school dispensary. Interestingly enough, less than one-third of the cases presenting occupational disease problems have proved to have an occupational disease as the principal diagnosis or cause of disability. Two-thirds of the total of more than 110 cases have had no evidence of disease that had a causal connection with their work.

The hospital and dispensary clinical studies are supplemented with a survey of the working place of all cases where this is feasible.

RESEARCH—Clinical research is limited by the kind and amount of case material presented for study.

The basic concept that any research must have practical value has likewise limited the extent of research study. A great many of the excellent publications in the field of industrial medicine have of necessity been curtailed by short time investigation. It was felt that only in a University could cumulative studies (and occupational disease in many instances is a study of chronic disease processes extending over many years) be investigated. At the present time material is being gathered on about 25 separate investigations, many of which are directed at measures to increase the accuracy of present-day diagnostic procedures.

The preclinical departments of the Medical School are actively cooperating in many of the problems being considered.

SURVEYS—The department has been called upon to make a few plant surveys. These are conducted on a preventive medical basis. As opportunity permits it is hoped that a safety engineer may be added to the staff.

EDUCATION—Education has been the presumptive theme song of public health achievement many years. Likewise it is true that education is of major importance in the maintenance of industrial health.

The educational activities of the Department of Industrial Medicine are:

Undergraduate Teaching

FORMAL Lectures:

1. Industrial Medicine—Three one-hour lecture periods per year presented to the senior class by the head of the department.

2. Junior Medical Instruction—The principal occupational diseases are covered in the various sections by several instructors.

Student Dispensaries:

1. Occupational Disease Clinic—One two-hour period each week is devoted to a discussion of some phase of industrial medicine. A group of senior students in their hospital clerkship quarter are regularly assigned to this dispensary.

2. Other outpatient dispensaries hold clinics on specific aspects of Occupational Diseases:

1. Dermatology.
2. General Medicine.
3. Neurology.
4. Chest.
5. X-ray.

Graduate Teaching

MEDICAL Council Monthly Meeting: Discussion of topics on industrial medicine and reviews of recent literature are presented.

Hospital House Staff meetings (Passavant Hospital)—Case studies are presented to the resident staff.

Hospital staff meetings have been presented at Passavant, St. Luke's and Norwegian American Hospitals.

Conferences with medical representatives of contributing companies. Requests for information submitted by them have been answered.

Clinics

OUTPATIENT department—Two two-hour periods of clinics weekly. Hospital—Cases studied at the Passavant Memorial Hospital.

LIBRARY—The library is an important part of any medical activity. Special emphasis has been placed upon this aspect in this unit. In the first 18 months several hundred volumes on occupational disease have been added to the library of the Medical School. All of the regular periodicals pertaining to the subject are subscribed to. In all about 500 periodicals are available for use. Considerable time and effort have been given to perfecting a satisfactory classification system. Card cataloging of reference material is carried out so as to make available the literature on many subjects. More than 5000 reference cards have been filed and many of them have abstracts. Reprints and reports from technical journals are continuously added.

The department conducts an annual occupational disease symposium. This conference is designed to bring together national authorities in the field of industrial health. Such conferences present excellent postgraduate opportunities for the medical officers of industry and the general practitioner.

The department is still in its infancy. Many shortcomings in organization and performance are apparent. However, it may be said that the unit has attained some level of usefulness, and with the counsel and cooperation of the University, industry, labor and various medical groups it is hoped that our future efforts may not be incommensurate with the anticipation of those who gave birth to its creation. As experience accumulates it is expected that organization and performance will be improved.

It is hoped that this department may serve to promote the organization of similar services in other educational institutions.

[NOTE: The Second Annual Symposium on Occupational Diseases, conducted by the Department of Industrial Health described by Dr. Fitz, to be held at Thorne Hall, on the Chicago campus, September 26-27, 1938, is announced on page 589, where the program is given.]

Arthritis in Industry

JOHN D. CURRENCE, M.D.,
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WITH due recognition of the tremendous importance of arthritis and rheumatic disease as a social problem, its importance as an industrial problem demands increasingly greater diligence on the part of the medical profession. Arthritis creates an industrial problem when it leads to disorganization of industry through loss of time in frequent absences from work and permanent disablement. It presents a problem not only of great economic import when prolonged care of an individual case is considered, but also a hazard of significance in the efficiency of personnel.

The logical trend towards preventive medicine in industry is indeed the first step leading to a reduction in the incidence of arthritis in industry. The next step hinges chiefly on earlier diagnosis and treatment. One of the principal difficulties encountered by clinicians in the management of arthritis has been in the lack of appreciation and use of well-proved data concerning the pathologic and physiologic changes. Much energy has been dissipated in attempts to demonstrate some particular inciting agent and to find some particular drug, vaccine or other therapeutic means which will cure the disease. It is true that in some clearly traumatic conditions this attitude can obtain with success, but the real reduction in incidence and duration of disability must be accomplished through the adoption of a broader perspective.

A careful examination usually reveals constitutional, neurogenic, hematopoietic or metabolic factors which cause or prolong the disability. Preemployment examinations and periodic physical examinations can be of signal value in this connection. Although the type of arthritis, whether atrophic or hypertrophic, depends upon the age, sex, kind of toxemia or infection, occupational strain, trauma and other factors, such an examination can isolate the predisposed individual and result in valuable phophylactic advice.

In general the potential arthritic may have:

1. Infections, either focal or general.
2. Faulty body mechanics.
3. Improper gastro-intestinal function.
4. Metabolic disturbances.
5. Circulatory disturbances.
6. Emotional disturbances.
7. Hereditary tendencies.
8. Lowered resistance.

These factors may be said to constitute arthritic soil.

The employee who is privileged to prevent potential disease is fortunate and the employer benefits by the increased efficiency. The physician for the employer has the advantage of referring to this examination record in the event of subsequent injury, and often can govern his management of the case more efficiently. Where such previous examinations are not made, to prevent long disability a comparable survey should be made following every joint injury.

THE most common chronic arthritic pathology encountered in industry may be said to be of the hypertrophic or osteoarthritic type. Hence, every individual presenting any of the anticipated predisposing causes of osteoarthritis at the time of injury not only requires treatment for his injury but also adequate combat of these factors. It is well to realize that every person over 40 years of age who suffers joint injury has a potential osteoarthritic sequelae. Family history is also important, because osteoarthritis appears to run in families. Faulty gastro-intestinal function should always be corrected because there is ample evidence to indicate that this is a definite predisposing cause. Most osteoarthritics have sluggish bowels whose movements are unduly delayed or incomplete. Some consider that an excess of carbohydrate may be a contributing factor. Some factors in the vitamin B complex may be present in certain cases.

Disturbances in circulation should be evaluated. It is known that osteoarthritic overgrowths may be produced in the patella of healthy dogs by diminished blood supply to the bone. Arteriosclerosis is commonly present in osteoarthritis. Individuals with cold hands and feet or with extremely dry skin may be more susceptible. Obesity seems to favor the onset of degenerative processes. This probably is due not only to circulatory strain, but chiefly to the unnecessary joint trauma from overweight. In these individuals there are rarely many gross physiologic disturbances, and they are likely to consider themselves in excellent health. Their blood pressure may be high or normal, but rarely low. Their temperature and pulse rates are not elevated. Their kidney function and urine are usually normal. Roentgenograms may suggest the tendency to retention of calcium in the body, but the blood calcium is usually normal. A consistently and continuously lowered metabolic rate is common. Women at or near the menopause seem much more susceptible. The presence of Heberden's nodes on the distal phalanges of the fingers should always excite especial caution.

The presence of any focus of infection may aggravate a degenerative joint process and provoke exacerbations following injury. However, to definitely list surgical foci of infection as a true exciting cause in osteoarthritis would not be in accord with competent opinions excepting that such foci, as a toxic factor, would indirectly excite osteo-

arthritic pathology through the effect upon body metabolism.

With due appreciation of these predisposing factors, the prevention of chronic disability in a potential osteoarthritic who has suffered a joint injury requires not only the surgical care of the injured joint but also the constitutional treatment of the individual. No set rules regarding treatment can be made. Of course, adequate rest is essential to a traumatized part, but too little exercise and incomplete combustion may inhibit proper elimination. Muscular tone must be improved and faulty body mechanics must be corrected.

Joints of the lower extremity should be spared the handicaps of pronated feet; the spine should be relieved of the drag of the heavy abdomen, the stoop of forward shoulders and the protruding head. The well-known effect of the sympathetic nervous system in the control of the capillaries must be combated by relief from emotional disturbances, apprehensions and worries.

Every possible means of favoring the blood supply to the joints must be used to prevent degenerative changes. In these cases the judicious use of physical therapy is especially indicated. This does not mean the indiscriminate use of baking and massage, or "B and M," as it is so frequently referred to in industrial clinics, but rather to the consistent and persistent use of some form of rational heat application which will improve the local or general circulation, or both. This means that in institutionalized cases the use of continuous hot, wet packs or frequent applications of infrared lamps, whirlpool baths, diathermy, etc., is indicated. For ambulant cases, in addition to such measures of thermal stimulation as may be desired, home treatments with frequent or continuous application of some form of heat are essential. In most of these cases, massage applied with kneading and stroking above and below the joints, but always avoiding pain, is beneficial. Where joint function is impaired, but true ankylosis does not exist, manipulation and exercise after thermal relaxation in an under-water therapy tank will often give marked improvement. Joint cases where osteoarthritic pathology exists probably offer one of the crowning opportunities to demonstrate spectacular results by the judicious prescription of physical measures.

ALTHOUGH osteoarthritis is more commonly encountered in industry as a cause of chronic disability, rheumatoid or otherwise termed atrophic or infectious arthritis must be reckoned with occasionally. These cases are more frequently observed during periodic examinations, and only very occasionally does trauma bring the patient to the industrial physician's attention. This, however, does occur at times during the very early manifestations of the disease. When we do meet with the infectious arthritis the period of disability is usually greater and the end result usually more distastrous. They are almost invariably poor physical specimens, frequently under-nourished. A joint injury may lower the local resistance and occasionally initiate the symptomatology, which will later spread to other joints.

It has been shown experimentally in rabbits that when a joint is injured and streptococci injected into the blood stream, bacteria have a much stronger predilection for the injured joint than for healthy ones. Acute respiratory infections or other frank foci of infection such as chronic infection of the tonsils, sinuses, teeth, etc., seem to be predisposing factors. Although the disease seems to present a definite picture of infection, there is no constancy in authoritative opinion relative to the specificity of the organisms involved. Although many of the bones tend toward rarefaction, the blood calcium usually remains within normal limits. The nitrogenous metabolism remains normal, and the time-worn withdrawal of meats seems to be a fallacy. They usually present a definite impairment in the peripheral circulation, and frequently are anemic. The course of these cases is usually slow, with aggravating exacerbations from time to time.

THE treatment, except in the very early stages, is very often disappointing. Many types of vaccines have been championed with hopes of specificity, but the conclusion of most authorities is that such benefit as may have been derived from vaccines is usually based upon the foreign protein reaction. Various diets have been suggested. Many medications have been used, but none with proved curative affect. During the period of definitely active infection, physical therapy occasionally offers some relief, but when used with any degree of enthusiasm it frequently excites aggravating exacerbations.

After the active infection is controlled, however, physical therapy applied in a manner comparable to that recommended where osteoarthritic pathology exists may be of inestimable value. The general consensus of authoritative opinion is that rest and symptomatic measures to increase the resistance of the patient, combined with very mild reactionary dosage by injection or physical therapy or possibly by the use of repeated small blood transfusions offer the most encouraging means of combat.

Although gonorrheal arthritis maintains its percentage of occurrence with industrial workers, it is less frequently the problem of the industrial physician. Occasionally, however, gonorrheal arthritis is precipitated by trauma in an individual who has recently suffered a gonorrheal urethritis.

In addition to the laboratory aids, by history, and following the acute major involvement, the transitory migration from joint to joint usually makes its diagnosis relatively definite.

The most accepted therapy seems to be the combined use of sulfanilamide and hyperpyrexia, and such treatment is usually rapidly effective.

Very occasionally, gout and gouty-arthritis may be observed in industry as well as hemophilic arthritis, alergic joint manifestations, etc., but these manifestations are indeed very rare in industrial practice. A frequent local manifestation in indus-

try is that of subdeltoid and subacromial bursitis. They may be accompanied by active infection. Many cases seem to be preceded by upper respiratory infections, but many cases present no evidence of infection whatsoever. During the acute stages the bursae are tense and very painful, and during this stage aspiration, procaine injections and immobilization seem to be the preferable mode of therapy. As soon as the acute phase is past, the use of hot applications, chlorine ionization, diathermy or short wave, followed by massage, manipulation and active exercise, preferably under water seem to be most efficacious.

HAVING considered the more common types of arthritis which may occur in industry or which suffer exacerbations from trauma, we will now consider those situations involving the joints which might be specifically related to trauma. Trauma may produce articular damage:

1. By an injury, whether minor or severe, which damages the articular structures with varying degrees of severity.

2. By the over-use or excessive wear and tear on a joint, due to occupation.

3. By repeated microtrauma from faulty posture or attitudes producing functional disability as a result of unevenly distributed intra-articular pressure.

The usual symptoms of pure traumatic arthritis result from the reaction of synovial, capsular or articular tissues to the irritative process. Pure traumatic arthritis is almost invariably monarticular. In these cases it is assumed that a normal and healthy joint existed prior to the injury, and unless, due to the severity of the injury or the constitutional state of the patient, circulatory impairment ensues or infection occurs, a quite complete recovery should result from ample rest alone.

Of course, arthritis in industrial practice is no different from arthritis in any practice, except that in industry the patient more frequently is presented suffering from an accident rather than as a patient seeking diagnosis and treatment for a symptom complex of a disease. Thus, it is easy for the busy industiary physician to consider only the active complaint, and neglect the constitutional analysis which may be of equal or greater importance in obtaining a good end result.

In conclusion, I would stress that not only should the joint injury receive the specific surgical care which is indicated, but also after a due analysis of the constitutional state of the individual, other treatment should be included as indicated, such as:

1. Ample rest for the relief of physical and mental fatigue and the alleviation of emotional disturbances.

2. Adequate diet for the correction of malnutrition and alimentary elimination.

3. Medications symptomatically for relief of pain, endocrine disturbances, anemia, etc.

4. Adequate combat of focal and general infections.

5. Adequate measures for the improvement of the general and capillary circulation.

6. Measures for the correction of faulty body mechanics.

7. Apparatus or surgery for the correction of deformities.

8. Physical therapy for its tonic effect for circulatory or metabolic effect, for relief, or for the prevention of deformity.

Discussion:

DR. HARVEY BARTLE (Chief Medical Officer, Pennsylvania Railroad): I want to congratulate Dr. Currence on his splendid paper. He is a colleague from New York, and as a doctor from Philadelphia I accept his suggestions and concur with them.

I am glad he suggested a generic term rather than a specific one, and that he has given us the academic aspect of the subject. It seems to me this covers almost everything, yet we know there is a geographic factor. The protean manifestations of the disease attract attention, and we know the causative factors he laid down are important indeed. Yet, all of us have met in our acquaintance, if not in our practice, individuals who have gold-crowned teeth, dead teeth, tonsilitis, and many other things, and yet have never had a manifestation of rheumatism. We can't account for this, with the multiplied factors that have run against them.

I don't know that I can add anything to what Dr. Currence said. His study and research are very broad and comprehensive, and I am sure that no one other than a New York physician would have the audacity so to approach a subject such as arthritis. I congratulate him on that score.

Someone said, in a lecture a while ago, speaking of dementia praecox, that you could move the septum over a sixty-fourth of an inch, take out the tonsils, remove the bulb matter, and you would still have dementia praecox.

I think it is much the same with arthritis. An officer came to me not long since and said: "What can you do for me?" He was an old arthritic case—a man who received a large salary, who was well nourished, and who came from a good environment. I asked him where he had been. He said: "Oh, I have been to such and such a doctor, the professor of a medical school; to Dr. So and So; and to Dr. So and So; and now I think I will go up to Canada and have my toe twisted at a dollar a throw. I think I will get better results." He went to another doctor in Philadelphia—a doctor with an outstanding personality—and now he is taking some injection treatments. I don't know just what sort of injections they are, but he has some improvement although the joints are still large. But I am wondering if it isn't the personality of the doctor rather than the medical science he is using. I think the man will reach Canada before long.

And I am wondering, too, whether from the industrial aspect we will soon have this as an occupational disease—as in round-houses where the men are exposed to all sorts of weather and outdoor work. In Cleveland, a while ago, they said: "We are having traumatic heart disease." I said: "Don't add anything else to trauma. In industry we have enough now."

I am connected with an industry that has a personnel group of 140,000 men. When a man twists his back, it is a traumatic case. X-ray, and you will see lipping of the vertebrae and exostoses all along the spine. What are you going to do with that individual? It will take more than hot baths to treat him and clear it up.

Then you have developed a confirmed cripple; he knows that he has lipping of the vertebrae and exostoses of the spine. Handle that case to a successful issue in a compensation court, if you will—it is the pat on the back from his friend that will aggravate it. I suggested sometime ago to a seminary in the East, where they are educating men for the ministry, that they include in the curriculum a course on applied psychiatry, so that the individuals going out to preach throughout the country will not go around to individuals sustaining a slight injury and

pat them on the back and sympathize. Do that, and before you know it, you have a psychotic neurosis along arthritic lines—and it would take a four-horse team to pull the man out, besides all the doctors in Philadelphia and New York.

If we can get at the source, to remove some of the accentuating causes and factors, we will accomplish something. I wouldn't for a moment minimize the splendid outline the doctor has given us. It is a splendid paper, indeed, but those are a few of the things that we meet in the industrial set-up.

Dr. Currence emphasized the family tendency, or heredity impact. I think that will be more pronounced in the future. However, he didn't mention the social status of the individuals studied. Are they the poorer groups, or those with smaller incomes? The man to whom I referred a moment ago had a splendid income. Is there a geographic setting that has much to do with it? We do not have so much arthritis in Philadelphia, and in the far south there is very little of it. But in the middle-west it is quite prevalent.

We were discussing at the luncheon table a new treatment—the artificial causation of jaundice. I am glad to know the doctor had an experience along that line. I think it originated in Mayo's, and I believe they are doing it down in Tucson, Arizona. Or course, Tucson has a splendid environmental influence—an equable climate, and all that. But is it the artificial jaundice or is it the climate that does the good? I don't know that the artificial jaundice would do as much good in New York and Philadelphia and New England as it does in Arizona.

DR. CURRENCE: Regarding the social and geographic factors, undoubtedly it is quite well known that arthritis does not occur, does not originate, in the tropics as it does in the temperate zones. There are certain predisposing factors that are noted so far as the instability of the sympathetic nervous system is concerned. Also, the type of arthritis that occurs varies.

As to occupational factors, it is quite true that those who work in damp conditions, those who have poor salaries and live in environments that are unhygienic, have a definitely greater incidence. This is an established fact. Such factors, of course, must come into this constitutional analysis that we are going to make if we are successfully to combat the disease. I can well appreciate that it will be difficult for the busy industrial physician to attempt to put on a program of preventive medicine. That is why I brought out the need for institutional facilities to carry out treatment in the early cases—those that could be healed when a comprehensive general program of treatment is established, rather than a search for some magic wand that can be waved, or some single method to combat a disease that has as many different predisposing and exciting causes as I have mentioned.

As to the scientific contributions that are being made relative to the relationship of jaundice in arthritis, that is indeed a very interesting piece of work. Undoubtedly, it does combat one or two of six or eight of the exciting and predisposing factors, and in some cases, where adequate combat is reached by the production of jaundice, possible benefit may be accomplished. But, from personal discussions with the men who have been doing this work, I am sure that none of them feels that he has found a cure for arthritis in the production of jaundice. That is merely an interesting study of a physiological reaction that occurs with jaundice when jaundice might combat a certain constitutional disorder. Certainly, it is not intended by these authors as any specific remedy that will combat arthritis in general. When we consider the multiplicity of the factors, the main point I would like to stress today is that when there is a traumatized joint, if the patient is a person over 40 years of age and with no evidence of active foci of infection, the most likely possible after effect that will occur is, as Dr. Bartle mentioned, lipping of the spine or the hypertrophic evidence in other joints. After all, everybody over the age of 50 does have some hypertrophic or osteoarthritic deposits here and there in the body. That is the natural process of age.

In some instances, the aging process occurs earlier, but if one is on the look-out and the individual is placed under greater precaution in this treatment with more rest and with more physical therapy and more immobilization at the early stages until the traumatic inflammation subsides, then the incidence of prolonged disability will be materially reduced, and very definitely so by such adequate treatment of the case at the time of injury—rather than if the industrial physician only considers that here we have an injured joint and doesn't consider the age, infection factors, etc. In the cases that do have active infection or endrocrine disturbances, other factors must be considered.

Distinction between Injuries of Spine, Spondylitis and Spondylosis

JOHN D. ELLIS, M.D., F.A.C.S.,
Chicago, Illinois

(Abstract)

THE purpose of this paper is to give a brief outline of present knowledge of the relation of trauma to certain inflammatory and degenerative diseases of the spine, especially from the roentgenological viewpoint. The use of the word "trauma" is here restricted to single occurrences of sudden mechanical external violence.

Spondylosis is the commonest affection to which the vertebral column of man is subject, and although the changes do not constitute a disease as such, they are really physiological responses to repeated mechanical stress or kinetic stimulation. The incidence of spondylosis increases with each decade past middle life; thus Garvin found, in 2,000 roentgenograms of the spine at the Mayo Clinic, made chiefly for a study of the urinary tract, that the condition was present in the lumbar region in 67% of men and 40% of women at 50 years of age and that 74% of the men and 61% of the women had no complaints referable to the back. He, therefore, believed that the degenerative changes were "incidental," and that it was improbable that a single accident was responsible.

Willis in the examination of 625 lumbar spines found that the normal characteristic at the age of 35 was practically no lipping; at the age of 45, however, 83% of the heavy body types and 10% of the slender types of individuals showed spondylosis. At 50 years of age all of the heavy types, at 55 all of the average types, and at 60 years all of the slender types, presented such changes.

The search for the identification of an infective

element in the etiology of spondylosis has been extensive and unsuccessful, and pursued by such investigators as Cecil, Nicolls and Stainsbuy in 1929; Nye and Waxelbaum in 1930; and Fray and Gowen in 1931. Both immunological and sedimentation tests have been done. The author has run 200 sedimentations by the Cutler method without one positive result, with the exception of one which was easily explainable by very definite source of infection entirely independent of the spondylosis.

Relative to the pathology of spondylosis, one is particularly concerned with the innervation of the ligaments of the spinal column. Since the osteophytes arise in the deeper and non-innervated ligaments, but not in the common ligament, they are certainly not pain-producing, as clinical evidence of their common occurrence in non-painful back substantiates. Distinction should be made between the innervation about the vertebral bodies with which we are concerned here, and the innervation of the small joints of the arches of the vertebrae which are supplied like other joints, with synovial pain endings.

The relationship of fractures is important. Although there is a common tendency to assume loosely that after compression fracture of the spine the changes produced about the affected vertebrae correspond to spondylosis, there is no evidence that this chronic degenerative affection of the spine is in any way influenced by a fracture of any one spinal element or vertebral body, or that it proceeds more rapidly after a vertebra has been crushed.

Arthrosis, or degenerative change in the small spinal joints, is likely to occur at an earlier age than spondylosis. The chief changes as shown in the roentgenogram consist of differences in the consistency or density of the borders and bases of the articular facets. The most conspicuous of such degenerative changes are found in connection with so-called static deformities, such as the dorsal kyphosis of middle age or later life, and other similar deformities.

Arthritis or inflammatory disease of the spine, as compared with spondylosis and arthrosis, is comparatively rare. In the earlier portions of such cases, there may be practically no x-ray changes demonstrable, in fact the disease may go on to complete cure without any roentgenological findings. In the chronic type, the articular spaces become narrowed and rarefaction of the articular processes occurs. Later, rarefaction of the vertebral bodies takes place and also calcification of the long ligaments, with an ultimate rigidity of the spine due to ossification of the small joints and of the intervertebral cartilages and ligaments.

Considerable confusion exists in the literature with regard to the proper use of the term "sacralization." Some authors find sacralization occurring as commonly as 60% in spines examined, while others consider this condition relatively rare. The use of an oblique x-ray view has eliminated many cases where sacralization appeared to be present in the anteroposterior view. With regard to the pain produced in sacralization, some investigators now believe that it is due to a periostitis and is probably identical with what we now call arthrosis.

The Role of the Industrial Nurse

—*In Ohio's Industrial Hygiene Program*—

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THE 1930 Census showed more than 49,000,000 gainfully employed workers in the United States. Of these, 15,000,000 were employed in the manufacturing and mechanical industries and in the extraction of minerals. There are now almost a thousand occupations in these industries where the materials, processes or environment are hazardous to health unless properly controlled. Industrial hygiene, then, is one of the major health problems in this country.

Dr. R. R. Sayers, of the U. S. Public Health Service, has stated that the function of industrial hygiene in its broad aspect is not only to prevent industrial accidents and diseases but also to maintain the good health of the industrial workers. The study of this field includes such subjects as poisons, dusts, abnormal temperatures and humidities, illumination, noise, overcrowding, hours of labor, fatigue, compensation, medical and nursing services, communicable diseases in industry, and mental and personal hygiene.

The industrial nurse, therefore, no less than the industrial physician, must have a broad knowledge of the entire field of industrial hygiene. She must be familiar with the various work processes and with the effects of the various exposures which are met by the workers in the industry where she works. She must know the diseases that are most often found and the symptoms that will warn her of the onset of these illnesses.

Modern industry has brought entirely new problems into industrial hygiene. These have come largely through the development of new industries, the invention of new processes, the use of new chemicals, the increasing size of industries, with the resultant crowding of the workers in cities and work-places.

Properly to evaluate the problems that confront industrial hygiene workers, one must keep several factors in mind. The first of these is: What is the health status of industrial workers in general and certain occupations in particular? For instance, we know that the average life expectancy of the industrial worker is seven years less than those not industrially employed. Furthermore we know that while our fight against tuberculosis has pushed it down to the seventh leading cause

* Read at Industrial Nurses' Institute, Western Reserve University, School of Applied Social Sciences, Cleveland, Ohio, June 11, 1938.

of death among the total population in Ohio in 1937, it still remained the second cause of death in industrial workers. Information such as this has been derived more or less until recently from morbidity and mortality statistics. The use of these statistics, however, has a great limitation and is apt to give an erroneous picture, particularly with mortality statistics. We must remember that a healthy miner, steel worker, pottery worker and any other worker in a hazardous occupation may contract some disease incident to his work and be forced to gravitate to an easier occupation such as watchman, gardener, or salesman, where his death may occur from the specific occupational disease acquired several years before. Hence, the true occupation is not charged with his death, and this type of error must inevitably result in under-statement of the mortality of the strenuous occupation and conversely over-statement of those occupations open to men of impaired health. Thus, there is in industry a general tendency for the stronger worker to seek a more strenuous occupation and for the weaker to seek the less strenuous. Therefore, this selective process is bound to affect occupational mortality statistics, and we must keep this in mind.

Another factor entering misinterpretation is the fact that the correct cause of death is not always stated on the death certificate. Understatement of syphilis and other causes is to be expected for obvious reasons, but other factors of wider scope tend to disrupt our analysis. For instance, unless a careful occupational history is taken on the worker who dies of heart failure, the fact that he had silicosis which was the true etiologic factor of his heart failure may be overlooked.

A study of death rates by occupations based on data of the U. S. Census Bureau for the year 1930, edited by Jessamine Whitney of the National Tuberculosis Association, has supplied much-needed information on mortality in this country according to social-economic class and certain component occupations.[1]

Of the seven social-economic groups to be considered, agricultural workers showed the lowest standardized death rate. Definitely higher mortality rate was found for other social-economic groups with higher and higher levels of mortality in the following order: professional men; clerks and kindred workers; proprietors, managers, and officials; skilled workers; and unskilled laborers. Statistics are always revealing, and I will touch on these lightly. The death rate among unskilled workers was more than 100% in excess of the rate among agricultural workers. Death rates for unskilled workers afford a striking contrast with those for agricultural workers in the age groups from 15 to 65. Among the unskilled the death rate in 1930 was 132% more than that of agricultural workers; for diseases of the heart 153% higher; for tuberculosis 297% higher; for cancer and other malignant tumors 89% higher; for pneumonia 213% higher; for nephritis, roughly, 100% higher; for cerebral hemorrhage 60% higher, for cirrhosis of the liver, almost 300% higher; and for accidents, almost 250% higher, after standardizing the death rates to eliminate age differences in the groups under comparison.

The test of sex differential in pneumonia mortality was used in the study by the Public Health Service of pneumonia among iron and steel workers. In the age group 15 to 45 the male pneumonia death rate in the city in which the study was made was almost twice the female rate. In certain departments of the steel plant studied, e.g., the blast furnace, coke ovens, open hearth, coal mines, and general labor departments (considered as one group), the pneumonia death rate was 4.3 times that of women at the same ages in the city as a whole. There was little evidence, therefore, that community conditions were responsible for the high pneumonia mortality among the steel workers.

In considering specific occupational diseases, we must not lose sight of the fact that they are not spectacular as are industrial accidents. Workmen do not shout, work-processes do not stop, and crowds do not assemble when a worker suffers from a slow poison. There is nothing particularly exciting in the gradual weakness of the hands of those absorbing lead, nothing arresting in the slowly progressive tremors of mercury poisoning, and no popular appeal in the chills of brass founder's ague, or the irritability, hallucinations or mania produced by carbon disulphide.

EVERY specific occupational hazard may produce an occupational disease. Occupational diseases have been grouped by Hayhurst[2] according to the causative factors which may be grouped as follows, and the industrial nurse should know each one thoroughly:

1. THE POISONS—such as lead poisoning. In lead poisoning we may find any of the following symptoms or signs such as colic; anemia; weakness; and sometimes even paralysis of certain groups of muscles, usually those groups most often used by the workmen; loss of weight; headache; and perhaps a blue line on the gums. In the poisons from the halogenated aliphatic series of solvents (such as chloroform and carbon tetrachloride) we most often find liver and kidney damages. Arsenic, benzol, wood alcohol, carbon disulphide, carbon monoxide, manganese, and others usually produce characteristic symptoms.

2. Mechanical irritants such as dust may produce dermatitis (cement itch), or, when inhaled, a group of diseases, usually referred to as the pneumoconioses. Silicosis, the best known of the pneumoconioses, is now believed to be due to chemical action of silica when it is dissolved in alkaline tissue juices.

3. Friction and pressure, such as constant pressure against parts of the body, produces such conditions as prepatellar bursitis, certain callosities on the skin, bony over-growths, and ganglion.

4. Fatigue, particularly of certain groups of muscles caused by repetitive motion, may cause such conditions as tenosynovitis, writers' cramp, eyestrain, and even neuroses.

5. Infections are, of course, not strictly limited to certain occupations. However, certain specific infections are seen much more often in certain occupations than in the general population. Anthrax has occurred commonly enough among those who handle wool to earn its synonym, wool sorter's disease. We see glanders quite often in horse tenders. Machinist's acne from continuous contact with oils and cutting compounds on the skin is the most common of all occupational diseases. Tularemia is quite often seen in butchers. All industrial physicians are well acquainted with the ravages in certain occupations caused by the fungi. Blastomycosis is often seen in paper workers. Aspergillosis, a condition also called "wheatena" is found in agricultural workers who handle grain and also in French pigeon growers. This disease is characterized by multiple small abscesses in the lungs, and radiographs of these healed lesions are sometimes mistaken for the nodules found in silicosis. Sporotrichosis, a disease characterized by refractory abscesses under the skin, is quite often seen in gardeners and malt handlers. This disease may become generalized and attack the muscles, bones, joints and mucous membranes. Herdsmen and farmers may contract actinomycosis from lumpy-jawed cattle they tend.

6. Diseases following accidental injuries at work, such as deformities, secondary infections, and fibroses, are sometimes classified as occupational diseases even though they follow acute traumatisms.

7. Among abnormal spectral conditions we may find illumination afflictions such as glass worker's cataract. Overstimulation of the optic nerve caused by looking at welding operations may cause electric ophthalmia. On the other hand, miners often develop "miner's nystagmus" or "dancing pupils" from a deficiency of light. Under other abnormal spectral conditions we may include sunburns and x-ray burns and the blood dyscrasias which follow over-exposure to x-rays and radium.

8. Extreme temperature changes form another occupational hazard. Abnormally high temperature may cause thermic fever, heat stroke, and heat cramps, while abnormally low temperature may produce frost bites and be a promising predisposing factor to colds, pneumonia, and even Bright's disease.

9. Noise, when abnormally loud and protracted, may in time produce a condition which is commonly called "boiler makers' deafness" because of the high incidence of that affliction in those workers.

10. Abnormal atmospheric pressure produces caisson disease in those who work in compressed air, such as tunnel workers, divers, and building foundation workers, when that pressure is too suddenly released. Reduced atmospheric pressure causes an illness formerly called "mountain sickness," but more recently called "aviator's disease." Quite recently a disturbance of the outer ear, with a thickening of the tympani, has been described in aviators and is believed due to frequent change from normal barometric pressure to the lessened pressure of high altitude.

In dealing with occupational diseases we must not lose sight of those changes from the normal which are best described as "conditions." These so-called "conditions" are the result of abnormal or prolonged motions or postures and evince themselves in a wide variance of ways such as flat feet, round shoulders, "habit movements," such as nodding of the head and motion of the hands, which are caused by frequent repetitive motion and persist after working hours. These conditions, while they are not evidence of true pathology, are certainly not to be desired and the causative factors should be removed.

One might think that primarily the problems that confront the industrial hygienist should, of course, rest upon the shoulder of the employer since it is in his employment that these hazards are met. However, in the United States, about 90% of all manufacturing plants employ 250 workers or less. Obviously, then, the vast majority of all manufacturing plants is small and it would be an impossibility for those plants to hire industrial hygienists, physicians, and nurses. Too, industry is not a health department. Responsibility for safeguarding the health of the industrial worker then rests chiefly with the state or local government.

THE State of Ohio has been interested in these problems since 1913, when Dr. Hayhurst and his associates undertook the study of industrial health hazards and occupational diseases in Ohio. A report of this study was made to the Legislature in 1915. In 1913, too, a law was passed that made the reporting of occupational diseases and diseases which the attending physician believed due to occupation reportable to the State Department of Health. In 1921, 15 occupational diseases were made compensable in Ohio. These diseases were: Anthrax; glanders; lead poisoning; mercury poisoning; phosphorus poisoning; arsenic poisoning; poisoning by benzol or by nitro and amido- derivatives of benzol (dinitro-benzol, anilin and others); poisoning by gasoline, benzine, naptha, or other volatile petroleum products; poisoning by carbon bisulphide; poisoning by wood alcohol; infection or inflammation of the skin on contact surfaces due to oils, cutting compounds or lubricants, dust, liquids, fumes, gases or vapors; epithelioma cancer or ulceration of the skin or of the corneal surface of the eye due to carbon, pitch, tar or tarry compounds; compressed air illness; carbon dioxide poisoning; and brass or zinc poisoning.

In July, 1929, three more occupational diseases, namely, manganese dioxide poisoning, radium poisoning, tenosynovitis of the flexor or extensor muscles of the hand, due to frequently repetitive motions or vibration, and prepatellar bursitis due to continued pressure, were added to the compensable diseases. In July, 1931, chrome ulceration of the skin or nasal mucous membrane, potassium cyanide poisoning, and sulphur dioxide poisoning were added. On July 31, 1937, silicosis became the twenty-second compensable occupational disease in Ohio.

In 1936, under Social Security, the Bureau of Occupational Diseases was expanded to a medical staff of three physicians, a chemical engineer, a chemist, and a technical assistant. Another stenographer was added at that time. Laboratory quarters and equipment were added, and plans for a mobile x-ray, clinical, and chemical laboratory were born. In the fall of 1937, this mobile unit was first put into use.

At the present time the functions of the Bureau of Occupational Diseases are as follows:

1. Investigation of the kind and extent of the diseases and poisonings to which workers in industry are subject in consequence of their work:

(a) By administration of the Occupational Disease Reporting Law (G.C., 1243) which requires physicians to report all diseases believed due to occupation.

(b) The evaluation of reports received from the physicians.

(c) By comparison of morbidity and mortality statistics gathered with those of other industrial hygiene units, departments of vital statistics, insurance companies and other sources.

2. Analysis of the findings of such investigations and the making of reports thereon.

3. Joint medical and engineering studies of all possible places where the health of the workers is excessively or needlessly endangered. This includes physical examination of employes with necessary laboratory and x-ray studies, specific determinations of dusts, gases, fumes, mists, and other toxic materials. Here may be included work relating to factory ventilation, illumination, and sanitation.

4. Cooperation with other state agencies (Industrial Commission and Department of Industrial Relations), other interests (medical and insurance), and agencies outside the State (The United States Public Health Service and other state health and labor departments) by consultations and conferences of technical nature concerning the health of workers in hazardous processes and trades, and to serve as an exchange medium of procedures most effective in an industrial hygiene program.

5. Consultation with physicians on request.

6. The care of requests for aid in all matters of industrial hygiene.

7. Determination and establishment of standards and thresholds to toxicity for materials encountered by the worker and devising of adequate control measures.

8. Special investigations and assignments as the occasions arise (e.g., carbon monoxide poisoning cases from domestic heating appliances and motor exhaust) and cooperation and assistance in other emergencies or calamities.

9. Supervision of the reports of periodic medical examinations of employees in those industries coming under the provisions of the "Lead Law."

10. Research into the effect of new materials and processes on the health of workers.

IT NEED scarcely be mentioned that a most cordial relationship and the heartiest cooperation should exist between the industrial nurse and the state industrial hygiene unit. Obviously, each can supplement and assist the other. The Bureau of Occupational Diseases can greatly aid the industrial nurse in her problems in several ways, a few of which I will mention here:

1. It can supply the industrial nurse with information as to what materials and physical factors encountered by employees in their work may cause occupational diseases.

2. It can supply statistics as to what diseases are commonly found in certain industries and occupations. Thus, the nurse may be more intelligently able to look for those diseases if she knows the causative agents and in what industries and occupations the maladies occur.

3. It can supply the nurse with information as to what occupational diseases are compensable. Thus, the nurse may advise the workers whether they are able to receive compensation for the diseases from which they are suffering.

4. It can supply the industrial nurse with information as to the more common methods of avoiding occupational disease; i.e., she should know that certain skin diseases can be avoided by using a protective coating of certain chemicals; that workers in lead manufacturing industries should always wash before eating and should not eat where their food is exposed to lead dust; and that workers in dusty trades should wear respirators, when other safeguards cannot be used. These, of course, are only a few methods used to reduce industrial morbidity.

5. It can supply the nurse who is also a technician with the latest laboratory procedures used in discovering occupational diseases. By the use of these procedures, such as the basophilic aggregation test for lead absorption, disease can often be found before physical signs and symptoms occur. The Bureau of Occupational Diseases has available the latest procedures for accepted blood studies and other procedures for the detection of occupational diseases often before they appear in standard textbooks.

6. It can act as a consulting organization and in an advisory capacity to assist the nurse in solving many difficulties that may arise in the pursuit of her profession.

One of the greatest functions of the industrial nurse is to preserve the efficiency of the employees by helping them to maintain sound health and mental peace. She can be of great help in finding means of eliminating accident and occupational disease hazards. She can minimize the seriousness of accidents by prompt first aid treatment. In the plant she is often able to detect symptoms of disease when it is in an early stage. While she cannot make a diagnosis she can insist that the worker have a thorough examination. By nursing care, she can speed return to work of all injured or ill workers. She can secure complete records of all accidents and occupational diseases, thereby, providing evidence for defense against fraudulent claims. These records are, in turn, valuable in establishing statistics for occupational morbidity and mortality and the causes of occupational diseases.

It appears to me that the industrial nurse can be one of the greatest factors in the success of the industrial hygiene program. In her close association with her patients she can gain their good will and confidence. As a contact with workers and as a salesman of better industrial hygiene, no one can surpass her if she so wishes. She must be a friend who has sympathy and clear insight into the worker's needs and his problems. Not only should she, but she must, become the foremost teacher of industrial hygiene and also of personal and mental hygiene. The growth of her work is only limited by time, by her strength and vision, and by her desire to see a difficult job well done.

References:

1. WHITNEY, JESSAMINE S.: Death Rates by Occupation. National Tuberculosis Association, New York, 1934, Table 8, p. 32.

2. HAYHURST, E. R.: "Occupational Diseases." *Timely Tidings on Tuberculosis,* September, 1935.

From the Archives

PHYSICAL examination can no longer be a matter of superficial inspection. In fairness to the man and in fairness to his employer, the job of examination must be done well and accurately.*

Does all this mean that only the man with a reasonably normal physique will be given employment? No; but it does mean that the old idea of "fitting the man to the job" will be supplemented by "fitting the job to the man." Physical capacity must no longer be thought of in terms of brawn, but it must be measured by intelligence, skill, judgment, and loyalty. Charles P. Steinmetz made the world more comfortable in spite of a crooked spine; Robert Louis Stevenson suffered long from tuberculosis and died of it, but in spite of that he made and continues to make glad the hearts of millions of children, both young and old.

We have to take men as they are; there are few indeed who can be rated as perfect physical specimens. There is plenty of work for all if we get out of the habit of thinking in terms of some conventional standard. We must fit jobs to human capacity—not the capacity of a perfect physique but the capacity of the great mass, both perfect and handicapped.

The wise management of an industrial establishment learns to see behind the obscuring camouflage of crooked fingers, thick eyeglasses, and dulled hearing of the old tool designer. When a foundry superintendent has a sudden rush of orders and needs an additional crew, does he want a bunch of young college athletes? No; he wants experienced molders—the more experienced the better. Of course, an old foundryman has a few scars and may have even a moderate fibrosis of his lungs, but in spite of these scars of toil he is the kind of soldier who makes it possible for management to win the battle of industrial competition.

I do not need to list the common defects that are found in any group of men applying for jobs, and I think I have made it clear that the knowledge of these defects is not for the purpose of keeping men from employment. Occasionally an applicant is found to be suffering from some contagious or infectious disease, and, of course, he should not be working at any job; he is sick, and working would be dangerous for him and his fellow employees.

The great occupational bugbear today is dust disease, particularly silicosis. Widespread publicity of all kinds — newspapers, radio, even the movies — has frightened great numbers of people, workmen, employers, and even the doctors. The only group who have not been frightened are lawyers of a certain kind. . . .

Seriously, routine physical examinations, both of applicants and employees, together with the occupational history, point the way to the danger spots in occupation. If the hazard is relatively important, *fit the job to the man — make it safe.* This can and will be done. If for no other reason, compensation for industrial disease will force the issue. No longer is it necessary to grind on sandstone; emery grinding can be, and usually is, done without serious hazard. With modern equipment, sand blasting can be made as safe as any water or equipped with effective dust exhausts, and so on down the list. It seems evident that sufficient medical and engineering talent can solve any of the occupational health hazards.

The modern concept of industrial relations is based on fairness, frankness, and honesty. Industrial management can understand the relative importance of any occupational health hazard only through the reports of its medical department, and the knowledge thus gained must be used for the benefit of the workmen — not to their disadvantage. Their benefit means better and safer working conditions — control or elimination of hazards — and just compensation where there is actual occupational-disease disability. All experienced managers know that the poorest and worst industrial-relations policy is to allow some workman to lose his job because he is about to become disabled because of some occupational health hazard.

Records of the physical condition of employees must be kept, tabulated and studied. It is only by such records that accurate and convincing data can be accumulated about any health hazard. It rarely happens that an occupational health hazard is conclusive and positive because of a single spectacular case; these hazards are usually evident without this case for demonstration. It is the type of hazard that has a cumulative effect over a long period, that is less evident, more subtle, but none the less serious, that requires long and accurate study. Again, industry through its medical advisers must not forget that the use of such records can serve to improve the relation of management and workmen, but if used to the disadvantage of the workers may spoil these relations.

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* JAMES A. BRITTON, Supervisor of Medical Service, International Harvester Co., at the 1936 Convention of the International Association of Industrial Accident Board and Commissions, Topeka, Kansas; "Discussion of Industrial Accidents and Diseases," Bulletin No. 10.

Congress of Railway Surgeons

—Program of the Forty-Ninth Annual Meeting, Chicago, September 19, 20, and 21, 1938—

THE Forty-Ninth Annual Congress of Railway Surgeons will be held at the Palmer House, in Chicago, September 19, 20, and 21, 1938. The Program, prepared by DR. A. R. METZ and his Committee associates, DRS. JOHN R. NILSSON and D. B. Moss, is given below. There will be the usual Scientific and Technical Exhibits, in the Exhibition Hall adjoining the Ballroom where the Scientific Sessions will be held. The Surgical Associations of the Chicago, Milwaukee, St. Paul & Pacific, Chicago & North Western, Illinois Central, Chicago, Burlington & Quincy, Pennsylvania, and Chicago & Eastern Illinois Railroads will participate in the Program. All members of the Medical Profession are cordially invited to attend any or all of the Sessions.

MONDAY—September 19

9:00-9:45 A. M.

Registration—Visiting Exhibits

Morning Session

ASSOCIATION PROGRAM

10:00—"Amputation Stumps of Lower Extremity"—DR. RAYMOND HOUSEHOLDER, Ass't. to Chief Surgeon, C. M. St. P. & P. R. R., Chicago.

Discussion opened by DR. OTTO W. YOERG, Company Surgeon, C. M. St. P. & P. R. R., Minneapolis, Minn.

10:30—"The Surgery of Peptic Ulcer"—DR. HOWARD K. GRAY, Surgeon, Mayo Clinic, Rochester, Minn.

Discussion opened by DR. ALFRED J. BROWN, Surgeon, C. & N. W. Ry., Omaha, Neb.

Intermission—30 minutes

CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC PROGRAM

11:30—"Diagnosis of Acute Abdominal Pain"—DR. H. IVAN SIPPY, Consulting Physician, C. M. St. P. & P. R. R., Chicago.

Discussion opened by DR. JAMES E. MCLOONE, Company Surgeon, C. M. St. P. & P. R. R., La-Crosse, Wis.

12:00—"Relation of Dental Pathology to Remote Body Pain"—DR. ROBERT L. LADD, Consulting Physician, C. M. St. P. & P. R. R., Chicago.

Discussion opened by DR. CHARLES A. KATHERMAN, Company Surgeon, C. M. St. P. & P. R. R., Sioux City, Iowa.

Afternoon Session

CHICAGO & NORTH WESTERN PROGRAM

2:00—"The Neurological Component of a Physical Examination"—DR. LEWIS J. POLLOCK, Consulting Neurologist, C. & N. W. Ry., Chicago.

Discussion opened by DR. ROLAND P. MACKAY, Consulting Neurologist, Illinois Central System, Chicago.

2:30—"The Relation between Arthritis and Injury and Arthritis"—DR. PAUL B. MAGNUSON, Consulting Surgeon, C. & N. W. Ry., Chicago.

Discussion opened by DR. WILLIAM H. HOLMES, Consultant, C. & N. W. Ry., Chicago.

Intermission—30 minutes

ASSOCIATION PROGRAM

3:30—"Interesting X-ray Problems" — DR. HOLLIS E. POTTER, Consulting Roentgenologist, C. M. St. P. & P. R. R., Chicago.

Discussion opened by DR. ARTHUR R. METZ, Chief Surgeon, C. M. St. P. & P. R. R., Chicago.

4:00—"Transportation and Treatment of Fractures"—DR. JOHN R. NILSSON, Chief Surgeon, Union Pacific Railroad, Omaha, Neb.

Discussion opened by DR. JAMES K. STACK, Surgeon, C. & N. W. Ry., Chicago.

TUESDAY—September 20th

9:00-9:45 A.M.

Registration—Visiting Exhibits

Morning Session

ASSOCIATION PROGRAM

10:00—"Some Allergic Manifestations as Observed in Railroad Employes"—DR. CYRIL M. SMITH, Surgeon, Northern Pacific Railway, Duluth, Minn.

Discussion opened by DR. CLARK W. FINNERUD, Ass't. Clinical Professor of Dermatology, Rush Medical College, Chicago.

10:30—"Clinical Aspects of Cardiovascular Disease"—DR. ROY W. SCOTT, Professor of Clinical Medicine, Western Reserve University, Cleveland, Ohio.

Discussion opened by DR. FRANCIS D. MURPHY, Consulting Physician, C. M. St. P. & P. R. R., Milwaukee, Wis.

Intermission—30 minutes

CHICAGO, BURLINGTON & QUINCY PROGRAM

11:30—"Hyperparathyroid Disease and Manifestations of Interest to Industry"—DR. EDWARD P. HELLER, Surgeon, C. B. & Q. R. R., Kansas City, Mo.

Discussion opened by DR. MICHAEL L. MASON, Surgeon, C. & N. W. Ry., Chicago.

12:00—"Lumbar Vertebral Fractures, Non-Operative Treatment" (Movie film)—DR. BENJ. V. MCCLANAHAN, Surgeon, C. B. & Q. R. R., Galesburg, Ill.

Discussion opened by DR. JOHN W. MARTIN, Surgeon, C. B. & Q. R. R., Des Moines, Iowa.

Afternoon Session

ILLINOIS CENTRAL PROGRAM

2:00—"The Surgical Treatment of Bronchiectasis" (Lantern slide demonstration)—DR. JOHN M. DORSEY, Consulting Thoracic Surgeon, Illinois Central System, Chicago.

Discussion opened by DR. DON DEAL, District Surgeon, Illinois Central System, Springfield, Ill.

2:30—"Appendicitis"—DR. JOHN W. BARKSDALE, Division Surgeon, Illinois Central System, Jackson, Miss.

Discussion opened by DR. BATTLE MALONE, Division Surgeon, Illinois Central System, Memphis.

Intermission—30 minutes

ASSOCIATION PROGRAM

3:30—"Mental and Emotional Instability, a Problem of Late Midlife"—DR. GEORGE T. HARDING, Consulting Psychiatrist, New York Central System, Columbus, Ohio.

4:00—"Trauma of the Larynx"—PROFESSOR CHEVALIER JACKSON and PROFESSOR CHEVALIER L. JACKSON, Professors of Clinical Bronchoscopy and Esophagoscopy, Temple University, Philadelphia, Pa.

TUESDAY

September 20, 1938—7:00 P.M.

Banquet—Grand Ballroom—Palmer House.

Address by the President, DR. HARVEY BARTLE, Chief Medical Examiner, Pennsylvania Railroad, Philadelphia, Pa.

Music.

Introduction of Officers.

"The Railroad Situation Today," by MR. J. M. SYMES, Vice President, Association of American Railroads, Washington, D. C.

WEDNESDAY—September 21st

9:00-9:45 A.M.

Registration—Visiting Exhibits

Morning Session

ASSOCIATION PROGRAM

10:00—"Bone Traction Splint for Fractures of the Humerus"—DR. T. VAN BOYD, Surgeon, Pennsylvania Railroad, East St. Louis, Ill.

Discussion opened by DR. RALPH G. CAROTHERS, Surgeon, Pennsylvania Railroad, Cincinnati, Ohio.

10:30—"Nerve and Muscle Injuries"—DR. DEAN D. LEWIS, Consulting Surgeon, Pennsylvania Railroad, Baltimore, Md.

Intermission—30 minutes

CHICAGO & EASTERN ILLINOIS RAILWAY PROGRAM

11:30—"Pneumonia in Industry"—DR. GEORGE F. O'BRIEN, Attending Physician, Cook County Hospital, Chicago.

Discussion opened by DR. JERRY J. KEARNS, Chief Pathologist, Coroner's Office, Cook County, Chicago.

12:00—"Acute Injuries of the Face"—DR. VILRAY P. BLAIR, Professor of Clinical Surgery, Washington University, St. Louis, Mo.

Afternoon Session

PENNSYLVANIA RAILROAD PROGRAM

2:00—"The Lever at the Top of the Femur: Its Surgical Elongation in Trauma and Disease"—DR. FRED H. ALBEE, Consulting Surgeon, Pennsylvania Railroad, New York, N. Y.

2:30—"Injuries and Tumors of the Spinal Cord"—DR. WALTER E. DANDY, Consulting Neuro-Surgeon, Pennsylvania Railroad, Baltimore, Md.

Discussion opened by DR. LOYAL DAVIS, Surgeon, C. & N. W. Ry., Chicago.

Intermission—30 minutes

ASSOCIATION PROGRAM

3:30—"Problems in Blood Transfusion"—DR. EGBERT H. FELL, Presbyterian Hospital, Chicago.

4:00—"Conservation of Hearing"—DR. AUSTIN A. HAYDEN, Aurist, Pennsylvania Railroad, Chicago.

Section on Railway Surgery

THE SECTION ON RAILWAY SURGERY, of the Southern Medical Association will hold its Annual Meeting in Oklahoma City, Oklahoma, November 15-18, 1938. DR. GEORGE A. TRAYLOR, of Augusta, Georgia, is Chairman of the Section; DR. OLIVER B. ZEINERT, of St. Louis, Missouri, is Vice-Chairman; and DR. JAMES W. DAVIS, of Statesville, North Carolina, is Secretary. The program of this meeting is as follows:

CHAIRMAN'S ADDRESS: "Is Medical Education Needed to Meet the Demands of Industry?" by GEORGE A. TRAYLOR, M.D., Augusta, Georgia.

"Railroad Surgeons, as I Know Them, in the Communities They Serve," by JAMES J. DONOHUE, General Claims Attorney, Louisville & Nashville Railway, Louisville, Kentucky.

Discussion by: J. D. COLLINS, M.D., Norfolk, Virginia.

"The Railway Surgeon," by J. R. GARNER, M.D., Atlanta.

"The Treatment of Fractures of the Hip," by LAWSON THORNTON, M.D., and CALVIN SANDISON, M.D., Atlanta.

Discussion by: H. M. MICHEL, M.D., Augusta, Georgia, and DUNCAN EVE, JR., M.D., Nashville, Tennessee.

"Head Injuries," by A. W. ADSON, M.D., Mayo Clinic, Rochester, Minnesota.

Discussion by: E. F. FINCHER, M.D., Atlanta, Georgia, and ERNEST SACHS, M.D., St. Louis, Missouri.

"Hand Injuries," by H. vH. THATCHER, M.D., Portland, Oregon.

Discussion by: C. C. GREEN, M.D., Houston, Texas, and P. D. ABRAMSON, M.D., Shreveport, Louisiana.

"Improved X-ray Technique in Studying Knee Joints, by E. C. HOLMBLAD, M.D., Chicago.

Discussion by: WILLIS CAMPBELL, M.D., Memphis, Tennessee.

"Abdominal Distention and Intestinal Obstruction Following Skeletal Injuries," by THOMAS G. ORR, M.D., University of Kansas, Kansas City, Kansas.

Discussion by: R. A. WOOLSEY, M.D., St. Louis, Missouri, and C. H. RAMSAY, M.D., Laurel, Mississippi.

"Eye Examination in Railroad Service," by B. C. DYER, M.D., A. T. & S. F. Railway, Topeka, Kansas.

Discussion by: E. S. FERGUSON, M.D., Oklahoma City, Oklahoma, and D. L. EDWARDS, M.D., Tulsa, Oklahoma.

The profession is invited; the meeting, as the program indicates, will be of profound interest to *all* physicians and surgeons, as well as those engaged in railroad work.

Pacific Railway Surgeons

THE Thirty-Sixth Annual Convention of the Pacific Association of Railway Surgeons will be held in Los Angeles on October 7 and 8, 1938, with headquarters at the Biltmore Hotel. An attendance of from 150 to 200 is expected from the several railroads in eight western states and Mexico. Industrial medicine and surgery will be well illustrated in a varied program, which includes the participation of aviation. The geographic scope of the conventions is wide. Last year's trip to Guadalajara and Mexico City was a remarkable one.

The officers of the Pacific Association of Railway Surgeons are as follows: *President*, DR. HARRY O. HUND, San Rafael; *1st Vice-President*, DR. RICHARD FLAMSON, Los Angeles; *2nd Vice-President*, DR. WM. L. WEBER, Los Angeles; *Treasurer*, DR. GEORGE W. BURGESS, Greenville, California; *Secretary*, DR. W. T. CUMMINS, Southern Pacific General Hospital, San Francisco.

This Association has nearly 300 members in

California, Oregon, Washington, Nevada, Utah, Arizona, New Mexico, Texas (western) and Mexico. As may be noted from the fact that the 1938 annual convention is its thirty-sixth, it has a history and background of interest aroused and sustained.

Occupational Diseases

THE Department of Industrial Medicine of Northwestern University Medical School has announced its second annual symposium on occupational disease, to be held at Thorne Hall on the Chicago campus, September 26-27, 1938.

Among the speakers and subjects are:

DR. CARL M. PETERSON, Secretary, Council on Industrial Health, A. M. A.—"Industrial Disease Education."

PHILIP DRINKER, Professor of Industrial Hygiene, Harvard School of Public Health, Boston—"The Scope of the Occupational Disease Research Problem."

DR. LEWIS J. POLLOCK, Professor of Nervous and Mental Diseases at Northwestern—"Traumatic Neurosis."

ARTHUR H. YOUNG, industrial relations counselor—"The Place of Medical Service in Industrial Relations."

DR. JOHN G. CUNNINGHAM, Toronto, Canada—"Industrial Plant Surveys."

DR. STANLEY J. SEEGER, Milwaukee, Chairman, Council on Industrial Health, A. M. A.—"Industrial Health and Safety and the Practicing Physician."

DR. EDGAR V. ALLEN, Rochester, Minnesota, and DR. JAMES G. CARR, secretary, and Professor of Medicine at Northwestern, will also speak on unannounced subjects.

Banquet will be held at the Blackstone Hotel on the evening of September 26, with DR. IRVING S. CUTTER, Dean of the Medical School presiding as toastmaster, and O. E. MOUNT, American Steel Foundries, speaking on "Industrial Health—The Responsibility of Labor, Management and the Community."

Industrial Hygiene : A.P.H.A

THE Industrial Hygiene Section meetings of the 67th annual convention of the American Public Health Association, to be held at Kansas City, Mo., October 25-28, 1938, should contain material of interest to all who have industrial medical problems. The preliminary program of these sectional meetings on the various days is as follows:

TUESDAY, OCTOBER 25: Address of the Chairman of the Section: "Development of Industrial Hygiene in the United States"—J. J. BLOOMFIELD.

"Health Maintenance in Industry"—CLARENCE D. SELBY, M.D. (Discussion: WILLIAM A. SAWYER, M.D.)

"Industrial Hygiene Program in a State Health Department"—CARL A. NAU, M.D. (Discussion: Manfred Bowditch.)

WEDNESDAY, OCTOBER 26: A symposium on the Control of Industrial Hazards:

"The Safe Operation of Degreasing Tanks Employing Trichlorethylene"—W. B. HARRIS, CH. E., C. B. FORD, and F. A. PATTY. (Discussion: HENRY FIELD SMYTH, M.D., DR. P.H.)

"Industrial Hygiene Codes"—JAMES R. ALLAN.

"The Effect on Health of Gases Produced by the Electric Arc"—LEROY W. LATOWSKY.

FRIDAY, OCTOBER 28: "Time Lost by Industrial Workers from Disabling Sickness and Accidents during the Early Days of Disability"—WILLIAM MCK. GAFAFER. (Discussion: R. D. MUDD, M.D.)

"Asbestosis"—R. R. SAYERS, M.D. and WALDEMAR C. DREESSEN, M.D. (Discussion: ANTHONY J. LANZA, M.D.)

"Compensation Insurance"—THEODORE C. WATERS.

National Safety Congress

THE National Safety Congress and Exposition, celebrating the Silver Jubilee of the National Safety Council, will be held this year at the Stevens Hotel, Chicago, October 10-14, 1938.

There are sessions on Dusts, Fumes, Gases and Vapors; Industrial Nursing; Occupational Disease; and Health Service in Industry, which should be of interest to the readers of INDUSTRIAL MEDICINE.

WEDNESDAY MORNING, OCTOBER 12 (Dusts, Fumes, Gases and Vapors Session)—WALTER S. PAINE, Mgr. Engineering & Inspection Dept., Aetna Casualty & Surety Co., Hartford, Connecticut, Chairman:

"Recent Developments in Detecting Hazardous Dusts, Fumes, Gases and Vapors"—WARREN COOK, Supt. Engineering Dept., Zurich General Accident & Liability Ins. Co., Chicago.

"Safety for the Man in the Tank"—(A Demonstration)—S. E. WHITING, Vice-President & Chief Eng., Liberty Mutual Ins. Co., Boston.

WEDNESDAY AFTERNOON, OCTOBER 12 (Industrial Nursing Session)—LAVONA BABB, R.N., Quaker Oats Co., St. Joseph, Missouri, Chairman:

"Problems in the First Aid Treatment of Fractures"—EDWARD C. HOLMBLAD, M.D., F.A.C.S., Consultant in Industrial Medicine and Surgery, Chicago.

"The Nurse's Part in the Industrial Relations Program"—BLANCHE LLOYD FRANCIS, R.N., Industrial Nurse, Carpenter Steel Co., Reading, Pennsylvania.

"Industrial Nursing from the Viewpoint of the Plant Management"—CHESTER S. JOHNSON, Personnel Mgr., The Quaker Oats Co., Cedar Rapids, Iowa.

THURSDAY MORNING, OCTOBER 13 (Occupational Disease Session)—PETER J. ANGSTEN, Chairman, Illinois Industrial Commission, Chicago, Chairman:

"The Trend of Occupational Disease Legislation"—HENRY D. SAYER, Mgr. Casualty Dept., Assn. of Casualty and Surety Executives, New York City.

"Handicaps in the Diagnosis of Occupational Diseases"—DR. CAREY P. MCCORD, Director, Bureau of Industrial Hygiene, Detroit Dept. of Health, Detroit.

"The Necessity for Uniform Absenteeism Records in the Industrial Health Program" — DR. M. H. KRONENBERG, Chief, Division of Industrial Hygiene, Illinois Dept. of Public Health, Chicago.

THURSDAY LUNCHEON (Industrial Nursing Group)—RUTH HOULTON, Associate Dir. National Organization for Public Health Nursing, New York City, Chairman:

"Greetings from the President, Chicago Industrial Nurses' Club"—GERTRUDE JAEGER, R.N., Swift & Co., Chicago.

"The Past, Present and Future of Industrial Nursing"—DR. M. N. NEWQUIST, Assistant Director, American College of Surgeons, Chicago.

THURSDAY AFTERNOON, OCTOBER 13 (Open Forum on Industrial Nursing Problems)—JOANNA M. JOHNSON, R.N., Nursing Service, Employers Mutuals, Milwaukee, and Chairman, Industrial Nursing Sec., N.O.P.H.N., Chairman:

Discussion Leaders are as follows:

F. W. BRAUN, Vice-President and Chief Engineer, Employers Mutuals, Wausau, Wisconsin.

DORIS CRAIG, R.N., Supervising Nurse, Koppers Coal Co., Mt. Hope, West Virginia.

MRS. SIDNEY HOOK, R.N., Plant Nurse, Abbott Laboratories, North Chicago, Illinois.

MRS. HAZEL H. LEEDKE, R.N., Shell Petroleum Corp., East Chicago, Indiana.

C. O. SAPPINGTON, M.D., DR.P.H., Consulting Industrial Hygienist, Chicago.

MRS. CHRISTIAN SEABROOK, R.N., Group Nursing Supervisor, Metropolitan Life Insurance Co., Chicago.

FRANCES E. SILBAUGH, R.N., Oscar Mayer & Co., Madison, Wisconsin.

FRIDAY MORNING, OCTOBER 14 (Health Service in Industry)—DR. C. D. SELBY, Medical Consultant, General Motors Corp., Detroit, and President American Association of Industrial Physicians and Surgeons, Chairman:

"Industry's Part in Combating Venereal Diseases"—DR. A. E. RUSSELL, Surgeon in Charge, Office of Syphilis Control in Industry, U. S. Public Health Service, Washington.

"What Can be Done About Fatigue?"—DR. HAROLD A. VONACHEN, Medical Director, Caterpillar Tractor Co., Peoria, Illinois.

"A Surgeon's Experience with Industrial Injuries"—DR. HARRY E. MOCK, Chicago.

Relationship of Industrial Medicine to Private Practice

C. D. SELBY, M.D.
Detroit, Michigan

THE public is accustomed to judge our profession by its ideals, ethics, altruistic objectives and best practices.* We of the profession do the same in judging the specialties of medicine. Surgery, for example, we judge by the collective accomplishments of good surgeons, not by the acts of general practitioners who occasionally venture into the abdomen. In this discussion, permission to judge industrial medicine by the same standards is assumed.

There are three classes of physicians practicing in relation to industry, full-time, part-time and on-call. As these designations imply, the full-time physicians alone give their whole attention to industry and that is always in one establishment. They are the only truly representative industrial medical group. The others are general practitioners or specialists who give limited attention to industry, usually in the treatment of occupational injuries and diseases. Being in general practice and only incidentally serving in industry, they can be regarded as private practitioners rather than industrial physicians, but it must be admitted that they furnish service to about 85% of the industrial establishments in the United States.

Confusion as to the purposes of industrial medicine has resulted from failure to distinguish the practices of these groups. In order that there be no misconceptions in this discussion, it is confessed that all conclusions as to the relationships of industrial medicine to private practice will be based upon the policies, ideals and best practices of the full-time group.

Industrial medicine as exemplified by this group is the theory and practice of medicine in relation to the health of the working people as distinguished from the case work of the private practitioners serving in industry. Fundamentally it is preventive medicine.

Its basic function is health maintenance, its object is to furnish employees the best possible health protection consistent with (a) the purpose of industry, which is manufacturing, (b) the employer's responsibility as fixed by law, which is the care of occupational injuries and diseases, and (c) the employee's rights as to free choice of medical counsel, which conversely are the rights of physicians in private practice in relation to non-occupational sicknesses and injuries among the employed groups.

This conception of the scope of industrial medicine is more inclusive than private physicians are prepared to furnish, as attested by the fact that their services in industry are usually limited to treatment of patients. Yet it recognizes their rights as private physicians as well as those of other parties concerned in the general problem of protecting the health of the working people.

As a matter of fact, industry is not in the business of practicing medicine and the ordinary employer does not wish to assume more responsibility for treatment than is required by law. On the other hand, if the size of his plant warrants, he is willing to furnish a sufficiently complete health maintenance service to protect his employees against harmful working conditions.

Viewing industrial medicine from this standpoint, it is found to comprise several functions which will be discussed under three headings—industrial hygiene, physical supervision and therapy, and in their discussion the relationships to private practice will be considered.

Industrial Hygiene

IN REALITY the physician is the health officer of the plant and as such as responsible for the plant hygiene, commonly known as industrial hygiene. He is familiar with the toxic materials that are used and the processes that have harmful though non-toxic features. His duty is to determine if the workmen are adequately protected against them, and if he finds that they are not it is his duty to inform his management and to persist until control is effected. Furthermore it is his duty to inspect controlled exposures often enough to satisfy himself that control is maintained. In short, his function as an industrial hygienist is to advise and assist his management in protecting the workmen against occupational diseases and other occupational impairments of health.

How he performs this function is not essential to this paper. It is purely preventive medicine and does not involve any competitive relationship with private practice. Nevertheless there are two features that should be given consideration.

1. AN OPPORTUNITY FOR PRIVATE PRACTITIONERS. As previously mentioned, private practitioners furnish about 85% of the industries the only medical service they have. It is in the form of medical and surgical treatments of employees who become injured or sick while at work. These sometimes are permitted to consult their own family doctors but usually they are referred by their employers to designated physicians, often certain nearly practitioners. In New York, they may consult physicians of their choice provided those physicians have

* Presented before the Section on Industrial Medicine and Surgery, New York State Medical Society, May 12, 1938.

qualified for compensation work under the law.

The point is this. Employers of all grades are becoming more generally conscious of the importance of industrial hygiene. Naturally, if they have hygiene problems they present them to the doctors who take care of their injuries. If they fail to obtain the desired advices, many of them do not know where to turn. It is therefore suggested that physicians in private practice who accept patients from industry prepare themselves to offer such advice or inform themselves on where such advice may be obtained. This is an opportunity that medicine cannot ignore.

2. DIAGNOSIS OF OCCUPATIONAL DISEASES. A history of harmful exposures is essential to diagnosis of occupational diseases. A workman must be exposed to silica to acquire silicosis; he must be exposed to lead to have lead poisoning; and the conditions of exposure must be such as to cause the disease.

Embarrassing failures in diagnosis have come from failures to ascertain facts as to exposure. It is therefore suggested that all physicians—industrial and otherwise—proceed with caution in the diagnosis of occupational diseases, and refrain from reaching conclusions until the possible sources have been found to be adequately harmful.

Physical Supervision

INDUSTRIAL hygiene methods are effective in preventing occupational diseases, in fact a great deal has been accomplished, and theoretically it may appear unnecessary to go any further except to maintain control. However, the plant physician has to face the issue of alleged aggravation of disease from time to time and often he is asked to treat what are to him obviously non-occupational conditions which belong to private practitioners.

In connection with these controversial cases, he always has important decisions to make and his decisions must be based upon facts—facts as to the exposures and facts as to the physical condition of the workman involved. These latter facts he can obtain only through physical examinations. So the physical examination of employees becomes a major function of industrial medicine, and furthermore it is essential to the maintenance of health which is the basic purpose of industrial medicine.

Examinations are made at time of employment to assure safe placement, often enough during employment to assure protection against diseases originating in or influenced unfavorably by occupation, and for diagnosis to establish occupational or non-occupational origin when counsel is sought.

3. PATIENTS ARE REFERRED TO PRIVATE PHYSICIANS. These examinations and consultations frequently uncover conditions that need medical care. As previously stated industry has no wish to treat ailments for which it is not responsible, but realizing the importance of early appropriate treatment, it is the duty of the plant doctor to encourage workmen needing treatment to seek early consultation with their private physicians.

This service in behalf of employees and their physicians is generally welcome. As a health maintenance measure, it is highly effective; and the interests of all parties concerned suggest that it be encouraged. A frank friendly relationship between the private physician and the plant doctor is very desirable.

Therapy

WHILE industry has no wish to assume responsibility for treatment, compensation acts have obligated employers to furnish treatments for occupational injuries and diseases. Naturally they expect their own doctors to render the service and this is usually done. However, the industrial physicians of the type under discussion are moving steadily from surgery to preventive medicine, and the evolution is leaving them dependent upon consultants, who are in reality private practitioners. Incidentally there is frequently much to be done by the plant physicians in behalf of employees discharged by consultants as cured before they can be placed satisfactorily back in industry.

So with the exception of minor injuries and the occupational diseases, which are infrequent, and considering the fact that private practitioners treat the injuries in about 85% of all industries, it is evident that the private practioners are dominant in the care of sick and injured workmen. About all that the plant doctor actually does in this respect is to act as a clearing house and to correlate the services necessary to adequate care of employees for whom his management is responsible. In short, he acts as a case-finding agency.

4. INDUSTRIAL MEDICINE IS AN ALLY OF PRIVATE PRACTICE. This trend on the part of industrial medicine to ally itself with private practice in the care of industrial patients should be encouraged. Industrial medicine is an honorable specialty of medicine. It is suggested that the general profession be made more cognizant of its ideals and objectives. As a means toward a better understanding, it is suggested that more medical societies follow the example of the New York State Society in organizing sections in industrial medicine.

The Real Problem

INDUSTRIAL medicine, as exemplified in the full-time service, is frankly admitted to be something new in the way of medicine. It is by no means a finished specialty, and no doubt there are still many features needing correction. Industrial physicians are well aware of this and their efforts are being directed with commendable sincerity toward betterment. They know that the care of industrial patients is not the ultimate potentiality of medicine in relation to industry, but that, on the contrary, it is the maintenance of employee health and they are striving toward that as their objective.

The full-time group, by use of industrial hygiene methods and by cooperation with public health officials and physicians in private practice, are meeting medicine's responsibility in a way that reflects credit upon the whole profession. But they view with considerable concern the inadequacies of the service rendered by private practitioners acting on a part-time and call basis in the care of sick and injured workmen in 85% of the indus-

tries of the United States. That service is not only inadequate, but it is also an important competitor of private practice. It is the real problem.

5. THE REAL PROBLEM IS THE PRIVATE PRACTITIONER IN INDUSTRY. As a means toward the solution of this problem, it is suggested that the private physicians in industry give heed to the reforms advocated by Dr. R. G. Leland, Director, Bureau of Medical Economics, American Medical Association (INDUSTRIAL MEDICINE, Volume 6, Number 5, page 303). He advocates:

"1. Recognition of a three-fold function of medicine—public health administration; plant control, or preventive medicine in industry; and care of the sick and injured workmen, or curative medicine;

"2. Acceptance of the expert in industrial health control as a specialist in medical practice;

"3. Formulation of criteria to determine to what extent and in what manner certain diseases are actually occupational diseases;

"4. Study to accomplish a reconciliation of the divergent views on freedom of choice of physician;

"5. Formulation of principles pertaining to the organization and administration of industrial health services;

"6. Study to determine the manner in which some instruction on industrial health problems and methods may be included in medical education; and

"7. Elevation of industrial health services and industrial medical care to a position of greater importance and respectability in medical practice."

There are no better closing remarks for this paper than those used by Dr. Leland himself. He said: "The welfare of the millions of industrial employees and the future of medicine demand that this phase of medical practice be stripped of its commercial aspects and that it be assisted to develop as a thoroughly ethical, scientific, and respectable phase of medical practice."

Disabling Illness

THE U. S. Public Health Service* in reporting on the morbidity experience among male members of 26 sick benefit organizations for the first quarter of 1938, as compared with the corresponding months of certain earlier years, states that the frequency rate for sickness and non-industrial injuries for the first quarter of 1938 (95.8) is the lowest that has been recorded for the first quarter of any year since 1934 (93.0).

Interest centers round the respiratory diseases, which are apparently chiefly responsible for the reduction of 35% in the frequency of sickness and non-industrial injuries of the first quarter as compared with the corresponding quarter of 1937. The rate for the respiratory diseases for the first quarter of 1938 (37.9) is 57% lower than the rate for the corresponding months of the preceding year (87.5), the former rate being the lowest first-quarter rate since 1934 (36.2).

Of interest also is the reduction of 31% in the frequency of infectious and parasitic diseases during the first quarter of 1938 as compared with the corresponding quarter of 1937.

* From the Division of Industrial Hygiene of the National Institute of Health, U. S. Public Health Service, Washington, D. C. Prepared by Dr. W M. GAFAFER and Miss ELIZABETH S. FRASIER.

New Books

Reviews by

EMERY R. HAYHURST, M.D.,
Columbus, Ohio

OCCUPATION and HEALTH—Supplement. International Labor Office, 734 Jackson Place, Washington, D. C., 500 pages (when completed), $5.00, including loose-leaf binding cover.

THIRTY-SIX articles in the form of separate brochures are announced for the complete Supplement to this well-known Encyclopaedia of Hygiene, Pathology and Social Welfare, the first volume of which, 999 pages, appeared in 1930, and the second, 1310 pages, in 1932, although the first article appeared in 1925. This Supplement is a complete revision and extension "in the light of subsequent progress," and this first installment comprises five brochures, totaling 86 pages, devoted to "Allergy and Occupation," 9 pages, by Urbach (Vienna); "Asbestos," 15 pages, by Gloyne and Merewether (England); "Beryllium (Glucinium)," six pages, by Gelman (Moscow); "Pneumoconiosis," 29 pages, by Teleky (Vienna); and "Silicosis," 27 pages, by Middleton (London).

"Allergy and Occupation," appearing now for the first time in the Encyclopaedia, is discussed under the subheadings: Definition, properties of the allergy, allergens, allergization, technique for detection of the allergen, anti-allergic therapy, clinical forms of occupational allergoses, prophylaxis of occupational allergoses, expert assessment in regard to occupational allergoses—followed by a bibliography of four references. It appears to be a compact authoritative statement of this prominent and more or less recent phase of occupational diseases to occupy considerable attention.

"Asbestos" is completely rewritten and extended by new authors and comprises, besides a general introduction: Extraction, manufacturing processes, risks to health, essential features of asbestosis, diagnosis, pathological features, the problem of asbestos dust, asbestosis and tuberculosis, preventive measures, compensation for asbestosis, and a bibliography of 15 references. There are also two figures of radiographs, six of lung sections by different staining methods, including two infra-red photomicrographs, and one freehand drawing of 41 different shapes of "asbestosis bodies." Two mortality tables accompany, the first pertaining to silicosis and asbestosis and the second to silicosis alone, taken from the Annual Report of the Chief Inspector of Factories (England) for 1935. There are also several footnotes, some rather extensive — particularly upon "asbestosis bodies." The subject is masterfully handled

"Beryllium (Glucinium)," a new article, is discussed under the heads of: Properties, uses, industrial processes. sources of risk, toxic action, pathology, hygiene, and therapy, followed by a bibliography of five references. This metal, which may be toxic in dust, gas, or fume form, is having continued extension of its uses in alloys where it has the peculiar property of almost eliminating "strain and stress," by which the alloys acquire a hardness and resistance five or six times greater than formerly. Having a low atomic weight (9.02) it therefore possesses great permeability to x-rays. Although known since 1798, a method devised by Copeaux in 1919 for extracting it from its ores has placed it in extensive commercial use. Its

frequent combination with fluorine and its extremely fine state of subdivision by which its gaseous products may be classified in the smoke group, increase its dangers to those exposed. Dermatitis, respiratory inflammation including bronchopneumonia, and the effects of exposure to heat characterize its use. While the first phase of poisoning is usually noted after a few hours of exposure, a second phase may follow a few days later in the nature of miliary pneumonia followed by pneumosclerotic changes.

"Pneumoconiosis" is also a new title in the Encyclopaedia, and comprises an extensive and very carefully prepared review of the subject in which Dr. Teleky has limited the discussion as well as possible to inorganic dusts not containing quartz, and in which pulmonary modifications in the nature of hilar accentuation, increased dendritic shadows, and reticular network with soft semidense mottling occur. The article comprises a *General Part* including the author's suggested classification of dusts under eight headings, in accordance with their action upon the system, two or three of which, to the reviewer, appeared to overlap somewhat, viz., *micro-chemical action* (quartz, asbestos), *chiefly chemical action* (Thomas slag), and *toxic action*. This part also includes a very thorough discussion of quantity, size, methods of estimation, chemical and physical properties, and pathogenic and radiographic effects of dust. The literature has been very carefully considered with added observations by the author. Three short tables accompany. One is profoundly impressed with the extent to which foreign workers have contributed to this whole field. The *Special Part* of the article is devoted to: *Organic dust* (grain, tobacco, wood, textile—flax, cotton—moulds and their spores, allergens —especially "ursol" or paraphenylediamine); *dusts which set up inflammatory processes* (Thomas slag, sulphur and its compounds, carcinogenic dusts); and *mineral and metallic powders* (sericite, lime, gypsum, limestone, marble, baryta, cement, clay, basalt, talc, magnesium, titanium, iron and iron ore, copper, bronze, brass and other metals, and miscellaneous). Silicates, asbestos, diatomaceous earth, and the peculiar effects of cryolite (described by Gudjonsson) which, although it contains only 3% of quartz, is said to produce a radiological picture similar to silicosis, complete the article. The author has found it advisable to add but a brief bibliography of seven citations comprising, however, chiefly titles of other extensive reviews and bibliographies, including that by Davis, Salmonsen, and Earlywine—published by INDUSTRIAL MEDICINE.

"Silicosis" is also a new title in the Encyclopaedia although a short article on *Silicon* appears there and there are numerous references to the disease in other articles. Here Middleton, after discussing the definition, takes up the historical aspects, symptoms, course and diagnosis, post-mortem appearances, silicosis and tuberculosis, silicosis and cancer of the lung, frequency of associated causes of death in cases of silicosis, treatment of silicosis, prognosis of silicosis, the reaction of the tissues to silica dust, the occupations in which silicosis occurs (to which considerable space is given), prevention of silicosis, the determination of industrial dust, and compensation (the latter with special reference to British schemes but not omitting methods followed in other countries). There is a bibliography of seven citations, chiefly to other extensive bibliographies as those of the Air Hygiene Foundation of America, the International Labor Office, Staub, U. S. Bureau of Mines, and the three volumes by Davis, Salmonsen, and Earlywine, above referred to. The article carries seven figures of radiographs, gross post-mortem appearances of silicotic lungs of workers in different trades, and one of iron ore impregnated with quartz; likewise, several tables and two graphs.

One still finds that the controversy waxes hot in regard to silicosis vs. tuberculosis, the value of air-borne dust estimations, and the significance of postmortem findings (especially in the absence of nodules in diffuse forms, and of more than the occasional finding of a tubercle bacillus). Undoubtedly too much dependence has been placed on mortality statistics which have caused many cases of silicosis to be called tuberculosis and to some extent the reverse, while the destructive action of ordinary infectious organisms has not been fully recognized. Perhaps the author might have cited more of the literature which opposes the tuberculosis relationship to silicosis, and more regarding acute silicosis, such as the reports of W. W. Betz, in Nevada in 1900, and the Symposium on Silicosis in the *American Journal of Public Health*, December, 1933. However, Dr. Middleton's article on Silicosis is undoubtedly the most reliable and complete recent summary of the subject.

The authors of these monographs have followed in general the convenient plan of citing various authors along with the dates of their publications. Material as late as 1937 is included. One gains the impression that the material is, in general, more carefully prepared and contains far fewer errors than occur in the volumes of the original Encyclopaedia. Certainly the remaining thirty-odd brochures will be awaited with eagerness, and it is to be hoped that a fitting index will eventually appear for the entire Supplement.

DISCUSSION OF INDUSTRIAL ACCIDENTS AND DISEASES: 1937 Convention of the International Association of Industrial Accident Boards and Commissions, York Harbor, Maine. Bulletin 17, U. S. Division of Labor Standards, Washington, D. C., 216 pages, 1938.

IN SESSIONS held from June 28 to July 2, 1937, the field indicated in the title was quite completely covered in some of its most important aspects by various specialists and by discussants. "Contrasts in Workmen's Compensation Legislation," by R. E. Wenzel, of the Division of Labor Standards, carefully analyzed the types of acts, whether compulsory, elective, insurance, or administrative, in the various States; the types of coverage (complete or limited); and the matter of procedures, appeals, types of benefit schedules, third party claims, etc., with review of the 1937 legislation throughout the country. There probably is no other place where so much information has been as well condensed and presented.

Attorney Charles F. Sharkey, of the same Bureau, gave a paper on "A Review of Recent Workmen's Compensation Court Decisions," followed by a paper by Marshall Dawson, also of the Bureau, "Surveying the Compensation Field," for which field work was completed shortly before the meeting.

Reports of special committees on universal risks and legislation follow, as well as a paper on "Recent Developments in Compensation Rate-Making Procedure," by W. F. Roeber, General Manager of the National Council on Compensation Insurance.

Of interest to many is the series of papers and discussions upon "The Administration of an Occupational Disease Law," by Harry A. Nelson, of the Wisconsin Industrial Commission; "Problems of Self-Insurance," by M. T. Howard, of the New York State Department of Labor; "The Commissioner's Control over Attorneys' Fees," by Commissioner O. F. McShane, Utah; and "Waiver on Account of Physical Defect," presented by Commissioner James J. Donoghue, Connecticut.

Physicians will be especially interested in the paper by Dr. Leonard Greenburg, "Some Aspects of the Problem of Occupational Disease Diagnosis," and the paper on "Choice of Physicians by Injured Employees," by Commissioner Emma S. Tousant, Massachusetts.

A report by William McCauley (Chairman of the U. S. Employees' Compensation Commission) of a special committee to consider "A Uniform Method of Rating Eye Disabilities" occasioned extensive discussion.

"Safety and Rehabilitation" occupied an afternoon session, with three papers. The first was by Sidney W. Wilcox, Chief Statistician of the U. S. Bureau of Labor Statistics, devoted to the "Heinrich Cause Code Operates" and relating to industrial injuries, with definitions, illustrative exhibits from reports, etc. The second paper was by John Roach, the veteran Deputy Commissioner of Labor of New Jersey, upon "Industrial New Jersey's Accident Problem," a State which Sir Thomas Oliver, following his last visit, dubbed the most highly industrialized spot on earth. Mr. Roach sketched the history of factory inspection through the eras of politics and theoretical experts to that of the highly trained technicians of today. Dr. Henry H. Kessler, Medical Director of the New Jersey Rehabilitation Commission, completed this part of the program with a characteristically forceful paper upon "Rehabilitation of Amputation Cases Under Workmen's Compensation."

The final papers comprised "The Agreement System of Workmen's Compensation," by Austin L. Staley, of the Pennsylvania Bureau of Workmen's Compensation, and the matter of "Competitive State Funds," by James E. Green, Superintendent of the Maryland State Accident Fund.

The Report concludes with a list of the officers and members of committees for the current year, the revised constitution of the International Association, a list of those in attendance from the various states, and an index of the entire proceedings. *Read and learn* is the comment of the reviewer.

More New Books

Reviews by

C. O. SAPPINGTON, M.D., DR.P.H.,
Chicago

Legal Medicine and Toxicology

DRS. GONZALES, VANCE and HELPERN have published a tremendous amount of material in the above volume, based very largely upon medical investigation of violent, sudden and suspicious deaths by the Medical Examiner's office of New York City.

Every phase of the coroner's investigation is included in the book, embracing identification, technique of autopsy, signs of death, various kinds of trauma, strangulation, asphyxia, abortion, and others. Toxicology receives excellent treatment with reference to gases, corrosives, inorganic poisons, and organic poisons, and toxicological analysis is given detailed treatment.

Of particular interest to the industrial physician is the section on occupational diseases and toxicology. This provides a good general discussion of the subject and naturally the subject matter is not detailed. The authors evidently prefer the older term "pneumonoconiosis" and also make allusion to the irritating properties of dust, classifying it as one of the physical substances. An older table of compensable occupational diseases in the State of New York was used in this section, this table not showing the more recent provision of "any and all occupational diseases."

The book is of especial value to the coroner and the postmortem toxicologist, and will have a certain amount of appeal to the industrial physician. As the authors state, the details of industrial toxicology may be secured in other works, especially those of DR. ALICE HAMILTON.

The book is well arranged and illustrated and contains 754 pages.

Published, 1937, by D. Appleton-Century Company, Inc., New York, it is priced at $10.00.

Health Education of the Public

THIS practical manual of technique by DRS. W. W. BAUER and THOMAS G. HULL, with a Foreword by DR. MORRIS FISHBEIN, is exceedingly timely. Industrial physicians more than ever need informational sources regarding health educational problems that occur in industry at the present time.

A glance at the chapter headings will give an idea of the immense scope of the material considered in the volume:

Definitions and Objectives; Source of Materials; The Radio; The Exhibit; The Meeting; Pamphlets; The Newspaper; The Motion Picture; Stereopticon Slides; The Magazine Article; Correspondence; Books; Miscellaneous Devices; Correlations of Technics into a Program; and Can The Results Be Measured?

The general arrangement of the book is excellent; there is a summary at the end of each chapter, and a competent bibliography at the end of the book. Excellent illustrations and tables are well placed.

The small volume should not only be of use to the industrial physician in his general health educational programs, but will be of especial value to him or to anyone else connected with industrial medical work, who must of necessity prepare talks or written articles.

The volume contains 227 pages with 39 illustrations; published by W. B. Saunders Co. 1937, and is priced in cloth at $2.50 net.

Toxicity of Industrial Organic Solvents

AT A period of time when interest is concentrated on industrial solvents, the material in this book should be of value to the heterogeneous group of individuals who are interested in the many problems arising out of the uses, and effects of such compounds.

Eight chapters deal with various groupings, such as hydrocarbons, the chloro compounds, alcohols, esters, cyclohexane derivatives, ketones, glycols, and certain miscellaneous compounds.

In the discussion of the various classifications of solvents, the properties, uses, toxicity, toxic effects in animals, toxic effects in man, are considered. References are given in each case following the descriptive manner, as applying to each organic solvent.

The published material does not purport to be a critical evaluation of present opinions, but rather extracts from existing and available information. As such, however, it should be of great valuee to those who are interested in the problems arising from the use of organic solvents. As a reference work, in particular, it should find continued usage.

The volume contains 396 pages, and is published as Report No. 80 of the Medical Research Council, Industrial Health Research Board, at His Majesty's Stationery Office, London.

The work was compiled by ETHEL BROWNING, publication date 1937, and is priced at 7s. 6d. The U. S. address is The British Library of Information, 270 Madison Ave., New York City.

Industrial Medicine

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VOLUME 7 SEPTEMBER, 1938 NUMBER 9

Incentive Taxation

AMONG the final acts of the Congress lately adjourned was the approval of a resolution by Senator ARTHUR H. VANDENBERG (Mich.), the pertinent paragraph of which is as follows:

"BE IT RESOLVED, That the Senate Finance Committee, or any subcommittee thereof, is authorized and directed to make a complete study of and report to the Senate upon all existing profit-sharing systems, between employers and employees, now operative in the United States with a special view (a) to the preparation of an authentic record of experience which may be consulted by employers who are interested in voluntarily establishing profit-sharing plans; (b) to the consideration of what advisable contribution, if any, may be made to the encouragement of profit sharing by the Federal government, including the right of compensatory tax exemptions and tax rewards when profit sharing is voluntarily established; (c) to the consideration of any other recommendations which may prove desirable in pursuit of these objectives; etc."

Pursuant to this resolution, a Subcommittee of the Committee on Finance of the United States Senate, composed of CLYDE L. HERRING (Iowa), Chairman; EDWIN C. JOHNSON (Colo.), and ARTHUR H. VANDENBERG (Mich.), has been established "to study profit-sharing systems in industry and the possibilities of incentive taxation." The Subcommittee has its office at Room 777, Federal Building, Chicago; and its survey is now under way.

Under the necessary implications of the terms of the resolution, and in view of the many and various forms in which profit-sharing has been and may be manifest, the Subcommittee has taken a broad view of the subject, and makes known that its desire is "to submit recommendations suggesting the incentive of TAX REWARDS to those who contribute to the welfare of the Nation by aiding in the solution of the unemployment problem through expansion of industry and the establishing of more harmonious relationships between employers and employees." Those in charge of the survey are seeking both experience with, and original thought upon, this interesting and *statesman-like* approach to a new and original angle in taxation.

This subject has possibilities so tremendous that it is not at all fantastic to pursue the logic of its premium on harmony to the point of the utter abolition of industrial strife—indeed, to the point where it might be the rule and guide of a new economic order. But, without going so far as that, without leaving the present-day purview of industrial relations, there are many phases of the efforts of industry to establish "more harmonious relations" with their employees which might reasonably be included among the things for which those who are doing them should be considered for compensatory tax exemptions or tax rewards. They are all profit-sharing in one way or another. In so far as the contract of employment is concerned, wherein wage is exchanged for work, and work for wage, they are *extra*-contractual, superimposed—like the non-contributary pensions used to be—upon the contract relation. Their cost may be a charge to operating expense rather than to surplus, but they all come out of profits, nevertheless, and their distribution in whatever form as it affects the individual employee is a sharing of profits with him. Stock ownership plans, bonuses, wage incentives, job guarantees, group insurance arrangements, even vacations and company contributions to employee activities, are entitled to consideration in this respect. It is probable that the Subcommittee survey will not overlook any of them.

The one, however, that we particularly do not want the survey to overlook is, of course, medical services for employees. We believe that, on a proper presentation, it will be found that there is no other extra-contractual employer-employee relation which in the aggregate distributes more of the money that is earned by industry to more people in a way that more specifically contributes to the welfare of the Nation than the already widespread and rapidly growing medical services for employees. It is our plan to prepare, as nearly as may be, such a proper presentation. Its progress will be noted in these pages from time to time.

Toxic Goitre and Its Effect on Industry

NORRIS W. GILLETTE, A.B., M.D., F.A.C.S.,
Toledo, Ohio

TOXIC goitre is found in every State in the Union, but one of its most common areas of incidence is the Great Lakes district, which has been called "The Work-Shop of the Nation" because of the location in this territory of many of the country's greatest industries.* It is pertinent, therefore, to determine whether goitre might have an appreciable effect on industry, either from the manufacturer's or employee's standpoint, and to this end it is important to know whether goitre is increasing or decreasing in endemic areas of our country or remaining stationary. If it is decreasing, our problem becomes less important, but if it is increasing more stringent methods of prophylaxis must be instituted.

The use of iodinized salt has been considered of value in reducing the incidence of goitre, but after a careful survey made of goitre, at my instigation, in the Toledo School System by Dr. R. M. Burton, it has been demonstrated that, in spite of the universal use of this salt in Toledo, a large number of pupils suffering with goitre of the endemic type have been found, most of whom have had no additional iodine as a prophylactic measure. The incidence is great enough to demonstrate that iodinized salt by itself is not sufficient to eradicate goitre.

We must, therefore, conclude that the present incidence of endemic goitre will remain permanent unless individual treatment is administered.

Toxic goitre is present in the ratio of 5.2% women to one man in my patients coming to operation and this ratio assumes importance with the advent of more women yearly into factory and commercial work. In one Toledo factory, The Doehler Die Casting Company, a careful clinical examination demonstrated at least one out of every 10 women was suffering from the effects of a toxic goitre as evidenced by the cardinal symptoms, the goitres differing in severity from mild to very severe, and nearly twice that percentage had palpable enlargements of the thyroid gland, without evidence of toxicosis. There are all gradations of thyroid activity, from myxoedema to a plus four hyperthyroidism, and there is no sharp line of demarcation between a normal thyroid and toxic goitre. At times the diagnosis of mild but persistent hyperthyroidism is extremely difficult. Those of a mild over-activity may remain so for years until some disease or strain activates them to a point where they do damage.

Along the sea shore 80% of all toxic goitres are of the hyperplastic or exophthalmic type, acute or fulminating, but in the Great Lakes district a majority of the enlargements of the thyroid are colloidal or adenomatous in character, frequently non-toxic, or moderately so, and of long duration. The individual who has had an enlargement for a long time without symptoms frequently does not blame the goitre for causing his trouble when it appears, and attributes his illness to some other cause such as overwork, family troubles, inherent nervousness, or other disease.

It is the long standing colloidal goitre gradually developing into the adenomatous type that is insidious in character and does damage without the patient realizing the cause of it. The toxicity is often intermittent in activity, flaring up after an acute cold, or after long and arduous periods of labor, and quieting down after rest or improvement in the infectious process. However, the repetition of the exacerbations almost invariably increases the severity of the attacks, until they become troublesome enough to demand medical treatment or surgery.

Unfortunately goitres do not cause pain, the nearest approach to it being the pressure symptoms or the anginal pains of the heart, due to overwork. Patients appear in a physician's office only when one or more of the cardinal symptoms of goitre drive them to it, or for cosmetic reasons in the non-toxic type. In their daily work the symptoms as they increase in severity affect the earning capacity of the patients and their value to the employer. These workers find it more difficult to do their work and keep up with the competition, and the realization of this by the patient aggravates the trouble and hastens the time when work is no longer possible. Many a patient whose subsequent diagnosis was toxic goitre has come to me with the history of a gradual failing of his or her driving power and work ability, frequently having lost his job or realizing that he is about to lose it, and all of the time not suspecting the cause of his failure, or at least not attributing a major portion of his disability to his goitre. Some of these sufferers keep on trying far beyond their capacities during this period because of their economic burdens, and often they bring themselves by their efforts, almost, if not quite, to the point where they can not be helped. Frequently in their efforts to keep working they wander from doctor to doctor, being treated for nervousness and heart trouble, having their tonsils removed, having their subluxated vertebrae adjusted by chiropractors and osteopaths, embracing Christian Science which, as has been aptly put, is neither Christian nor science, drinking irradiated water, taking special diets, and resorting to various procedures until eventually they summumb to the disease or are fortunate enough to locate a physician who directs their treatment into a rational method.

In considering the reasons why patients who are suffering from goitre finally end up in a physician's office, it is important to remember that those about them, both at home and in their daily work, usually notice a change in them before they are aware of it themselves.

The symptoms that are most important are as follows:

1. *Enlargement of the Thyroid Gland.* — The thyroid is usually at least slightly enlarged in hyperthyroidism, although the gland may be so deeply buried that it is palpated with difficulty. Normal glands weigh from 15 grams upward, varying with the individual, but the inert colloid in a small gland may be replaced with active cells producing thyroxin, so that it is possible for a small gland to be very active. This may be the type of gland that is causing the most harm, because it is not easily seen and is often overlooked in the search for the cause of the trouble. Patients are, however, beginning to realize that a noticeable gland is not necessary to produce toxicity. The irregular tumefactions are either adenomas or cysts and are objectionable in their appearance, especially to a woman. Those enlargements hinder any indjvidual in his daily work, if they are great enough to become noticeable or can not be covered by clothing. In Switzerland, where five out of seven women have goitres, the appearance of goitres is not objectionable due to their prevalence, but in our country a large nodular goitre is a distinct hindrance to any one applying for a position. If a man is a salesman his customer is so interested in watching the movements of the enlarged thyroid that he is apt not to hear what the man is saying.

2. *Choking Sensation.* — Choking sensation is closely allied with the enlargement of the thyroid gland. When the thyroid is substernal or subclavicular and enlarging, it must press on the trachea, producing the chocking sensation. It may cause great narrowing of the tracheal lumen, but the

* Read before the Association of C. & O. Railway Surgeons at White Sulphur Springs, W. Va.; published in *Virginia Medical Monthly*, August, 1938.

sensation appears to be reflex. A small hard goitre wrapped tightly around the trachea gives the same sensation. Riedel's struma or the thyroid of Hashimoto's disease may become so hard and contracting as to cause a definite tracheal constriction.

3. *Palpitation.* — Palpitation of the heart is apt to appear early in the disease. It may be the first sign of hyperthyroidism, occurring at intervals following hard exertion or becoming noticeable at night while lying down. It persists as one of the cardinal symptoms of goitre. The beating of a normal heart is not seen through the chest wall. If the apex beat is plainly felt when the hand is placed on the chest, the thyroil gland should be investigated.

4. *Tachycardia.* — Tachycardia follows palpitation and is a good indication of the severity of the disease. The thyroid is driving the heart by increasing the demands upon it through increased metabolic activity. Eventually the tachycardia will be so great that the heart musculature will play out, but it will maintain a relatively high rate for months and even years before it wears out enough to demonstrate valvular insufficiency. Auricular fibrillation appears late in the disease and when present is a good indication of the extent to which the heart musculature has been driven. Valvular murmurs are not evidence of thyrotoxicosis.

5. *Fatigue.* — Comparative fatigue tests and individual muscles in normal and goitrous people clearly indicate that the reserve glycogen has been used in those suffering from thyrotoxicosis to the extent that the muscle fails in a much shorter time than that of a normal individual, depending entirely on the grade and duration of the thyrotoxicosis. In neuro-circulatory asthenia the patient is rested by sleep, but in toxic goitre the patient is as tired in the morning as he was when he went to bed. Chronic fatigue is a good diagnostic symptom of goitre.

6. *Nervousness and Irritability.*— Nervousness and irritability are usually the first symptoms of toxic goitre to make their appearance. These symptoms are manifested in many ways—by marked excitability of the patient in the presence of slight accident, by evidence of annoyance over trivial things, and by his or her inability to associate normally with others. Frequently husband and wife who have lived peacefully with each other for many years have their pleasant relationship broken by an interfering goitre in one of them and many divorces have been the result of this. A man with thyrotoxicosis who has been, when normal, a good workman in a factory annoys his associates, takes offense over fancied slights, and believes that his working conditions which previously have been satisfactory are now changed, and he either leaves his good position, or becomes a soap box orator with a vitriolic tongue and makes

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others believe that they and he are suffering intolerable wrongs. This nervousness, together with the workman's inability to do a normal days labor because he is continually fatigued by the increased metabolism, brings down criticism by his superiors, and a good mechanic is soon out of a job—due to pathology which could have been eradicated by a timely thyroidectomy.

7. *Variation in Weight.*—Variation in weight is the direct result of a change in the metabolic rate. Due to the increased metabolism there is a need for increased fuel to burn and as a result the appitite is over-stimulated and at times the patient puts on weight, in spite of the increased need for food, but as the metabolic rate increases the need finally passes the ingestion of food and there then follows a marked loss of weight. If the appeite fails, as it may, the loss of weight is very rapid, associated with a marked loss of strength, making it difficult for the patient to do his normal work.

8. *Eye Changes.*—Eye changes develop with increased toxicity. In hyperplastic goitre there appears an exophthalmos in approximately 50% of the cases. The exophthalmos is disfiguring, but more important is the fact that there may ensue a stretching of the optic nerve with some injury which causes a lessening of acuteness of vision. Usually after a thyroidectomy there is some recession of the eyeballs with an associated improvement of vision, but at times the exophthalmos is progressive and may cause total blindness if allowed to continue without relieving the pressure behind the eyeballs. Naffziger's operation is now saving the vision of some of these sufferers. In addition, without the disfiguring exophthalmos, there is usually some change in the vision in cases of toxicity of long duration or marked severity and after the thyroidectomy the vision improves for some period of time. The glasses that the patient has worn before the operation are unsuitable after operation, necessitating a change in them. It is not advisable to have them refitted, however, for a period of six months after thyroidectomy because improvement is gradual and progressive for at least that duration, but after six months an optic *status quo* has been established

9. *Gastro - Intestinal Symptoms.* — Hyperacidity and chronic indigestion are common in cases of well advanced toxic goitre. Patients have had their gall-bladders removed without improvement, when in reality the trouble was due to the thyrotoxicosis. The overloading of the stomach due to the increased appetite of these people aggravates the gastric instability.

All of these symptoms may not appear in the origin of the disease, but will probably follow in irregular order and severity. They are constitutional symptoms affecting the individual's ability to work, but giving

ample warning, not as acute appendicitis or pneumonia in which an individual is perfectly well one day and totally disabled the next, but hanging out the red flag of danger for months or years—warning the sufferer to care for himself. In individual instances I have known of a goitre patient losing control of himself and allowing a valve to open, spraying hot metal over other workmen and himself. Another individual, too fatigued by the ravages of his thyrotoxicosis to attend to a valuable boiler, allowed it to be burned out. Still another toxic individual originated an argument which brought on a melee in a factory and stopped two days production. Such instances, if carefully looked for, can be found frequently, but it is only after examinations that they are connected with goitre. In many factories only a casual examination, if any, is made of the thyroid gland at the time of employment. Herniae, which are made much of, may not be doing as much harm but may eliminate the man from employment, whereas the moderately enlarged thyroid gland causing tachycardia and frequently increased blood pressure are overlooked, but their damaging effect on the individual and the factory may be as great as that caused by any other disease, for the thyrotoxic individual is kept working while in an unrecognized but none the less dangerous condition.

This paper is written because of my desire to bring to the attention of the profession, particularly those physicians engaged in the examination of applicants for positions in industry, the advisability of carefully examining the applicant for evidence of symptoms of thyrotoxicosis, in order that both the employer and workmen may be protected from damage resulting from goitre. Brought to a realization of the endemic character of the disease by many surveys that have been made, it behooves physicians engaged in industrial work to examine workmen for thyrotoxicosis as carefully as they are examined for any other physical defects. In the incipiency of goitre much can be done by medication to abort it and, when found, advice as to treatment should be given. Also, thyroidectomy should be advised in active cases with the idea of conservation of valuable workmen and protection to the industry.

Carbon Monoxide Headache and Anoxemia

THE typical carbon monoxide headache has been described many times and is familiar to all persons who have been exposed even to relatively small amounts of this gas.* It is a pounding and intense headache—either basal or frontal—which is associated with nausea, and is in-

* May R. Mayers, M.D., Division of Industrial Hygiene, State of New York Department of Labor in *Industrial Bulletin*, July, 1938.

The Industrial Doctor

OFFICIAL SECTION OF THE NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE

Published under supervision of the Ways and Means Committee of the New York State Society of Industrial Medicine. Editorial office, F. E. Redmond, Managing Editor, 361 Delaware Avenue, Buffalo, N. Y. Articles appearing herein do not necessarily reflect the opinion or policy of this journal nor of the New York State Society of Industrial Medicine.

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creased by bending. Clinically, it strongly resembles headaches seen in persons suffering from brain tumor or other conditions characterized by increased intracranial pressure. Pathologically, it has been shown to be due to edema of the brain, and this has been the rationale for the relief which follows the administration of magnesium sulphate. There are certain aspects of the headache, however, which have not been sufficiently considered, and which present problems the answer to which might be of fundamental importance in clarifying our understanding of the general toxicological effects of carbon monoxide gas.

It is the generally accepted view—particularly in this country—that carbon monoxide gas is not a tissue poison, and that all of its pathological effects may be fully explained on the basis of the anoxemia, or tissue asphyxia, which it produces. That its principal effects are due to this action is established beyond any question—particularly in acute poisoning. When only relatively small amounts of this gas are absorbed, however, the anoxemia theory does not seem to provide as complete an explanation for all of the manifestations of poisoning which one encounters. It does not seem, for example, to fully account for the typical carbon monoxide headache.

The most puzzling, and at the same time the most important, feature of the carbon monoxide headache is that it comes on when there is as little as 10% saturation of the blood with carbon monoxide gas—or, at times, even less. Obviously, with so low a saturation, the oxygen reserves of the body are in no way compromised; there is still an ample oxygen supply to tissue cells, and there would seem to be no very good reason why an edema of the brain should develop so early.

If one follows this line of thought further, one is impressed with the extraordinary fact that in other conditions or diseases—where there is no exposure whatever to carbon monoxide gas—a far greater degree of anoxemia is not characteristically associated with this particular type of headache. In ascents in balloons, or in aeroplanes, for example; in severe anemias, or leukemenias, where the hemoglobin may drop to 20 or 30%; in pneumonia, where the anoxemia to tissue cells is sometimes so severe as to threaten life itself, and in other conditions which could be mentioned, headache, analogous to the carbon monoxide headache, is neither an early nor a prominent part of the symptom complex. Indeed, there may be no headache whatever. If there is a corresponding edema of the brain in these other conditions of oxygen deficiency, for some reason or other, its clinical manifestations are, apparently, not precisely the same as those in carbon monoxide poisoning.

On exposure even to very small amounts of carbon monoxide gas, the headache is characteristic and early symptom. Clinically, it is always the same kind of a headache, and is so intense as to completely dominate the picture—putting every other discomfort into the background so far as the patient is concerned. Furthermore, while there are, normally, enormous differences in the susceptibility of individuals to toxic substances generally, these differences are not nearly so great in the matter of susceptibility to this headache. Practically everyone exposed to carbon monoxide gas experiences it.

In a previous article[1] the question of the relative toxicity of pure carbon monoxide, and carbon monoxide in mixed gases (such as the exhaust gas from automobiles and illuminating gas), was discussed. It was suggested that the greater toxicity of the mixed gases may, in part at least, account for those elements in the clinical pictures which have always been difficult to interpret solely in terms of oxygen deficiency (anoxemia). This may possibly be the explanation of the carbon monoxide headache.

In the absence of further evidence, it would seem as though one must face the fact that the anoxemia theory of carbon monoxide intoxication, as we now understand it, does not seem to explain fully the carbon monoxide headache—the fact that it develops regularly on exposure to carbon monoxide gas when tissue anoxemia is relatively slight, and may be absent in other conditions where there is a very severe anoxemia but no exposure to this gas. Most of the work that has been done has been with acute carbon monoxide poisoning where tissue asphyxia is intense. It is conceivable at least that under these circumstances it wou'd be most difficult to dissociate and evaluate any other relatively less important mechanisms which may be at work at the same time. Perhaps such mechanisms can only be detected by studying persons exposed to low concentrations of the gas where tissue anoxemia is never sufficiently great to be physiologically important.

It is believed that a better understanding of whatever factors are involved in the production of the carbon monoxide headache would contribute materially to our understand-

1. M. R. MAYERS: Exposure to Carbon Monoxide in Mixed Gases, *The Industrial Bulletin*, September, 1937.

ing of other systemic effects of carbon monoxide inhalation—particularly under conditions of industrial exposure where, generally speaking, only the relatively low concentrations of the gas prevail.

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